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TRAVELING AND COLLECTING IN MEXICO

By A. SORENSEN

Now that Mexico has become one of the combatants in this the greatest of all world contests it is going to be more difficult for other nationals to enter or leave it, because border regulations on both sides are much stricter than formerly. So it may be of interest to record some previous trips and tell what was seen and what was achieved in the way of collecting marine life in the Gulf of California.

For some years previous to 1940 the writer had made short trips into the northern part of Lower California, known to the Mexicans as Baja California. It is that long narrow peninsula with its backbone of fairly high mountains that extends south from California for more than 750 miles. It is bordered on the west by the Pacific Ocean and on the east by the Gulf of California. The backbone mentioned is the southward continuation of North America's mighty Coast Range, which, under various names, forms a barrier against the inroads of the Pacific from Alaska to Cabo San Lucas at the southern tip.

The roads from San Diego are fairly good to Ensenada, but south of that they are "not maintained." There are no culverts or bridges across the numerous arroyos and short swift rivers flowing into the Pacific, so traveling southward is practically at a standstill during the winter.

In January 1940 a party consisting of Mr. and Mrs. H. R. Turver and Mr. and Mrs. John Strohbeen, all connected with the Santa Cruz, California, Museum of Natural History, and the writer from Pacific Grove, California, were desirous of going down the west coast of Lower California, at least as far as San Quentin Bay, but preferably farther. Investigation proved that the streams were swollen and the flats were boggy, so we had to look for another entrance into Mexico.

From Mexicali, on the border, a road extends south for about 135 miles to San Filipe a small fishing village on the Gulf and not far south of the mouth of the Colorado River.

This would be a desirable place to go, for the marine life there is the Panamic fauna, while that of the west coast is classified with the California Province, which means that you would find practically the same mollusks there as at San Diego, about half way down the peninsula, though, in the vicinity of Cedros Island, the Panamic and the California faunas seem to overlap. But no matter how desirable a trip to San Filipe might be, still it, like the West Coast trip was out of the question, for the road was actually impassable at that time of the year. A considerable portion is a quagmire in wet weather and a speedway when dry.

So we had to look still farther east, and learned of a so-called good road leading south from Nogales, Arizona, for 265 miles to Guaymas on the east side of the Gulf of California. This we then decided to explore, and thus it was that we discovered this naturalist's fairyland and became so enraptured of its charms that we are making it the object of our annual outing. Three such trips are behind us, and we are hoping for more as soon as war conditions permit.

Nogales is 498 miles east of San Diego, over such excellent roads that this added distance is not much of a handicap. The road in Mexico is well laid out and well graded, but it is not paved and in many places is poorly surfaced and quite rocky. The Mexicans take their roads philosophically and use only six ply tires on their autos. No four ply tires were for sale in that part of Mexico.

The towns of Magdalena and Santa Ana, some sixty and seventy-five miles below the border, are interesting places with their adobe buildings and narrow streets. Considerable mining of copper and silver is carried on in this region, and fairly extensive farming is found in the lowlands near by.

Hermosillo, the state Capital of Sonora, is about another hundred miles south.

It is an ancient city with modern improvement. It has paved streets and good schools. We found that both here and in Guaymas, English is taught in the high schools and in the upper grades of grammar schools. It is noteworthy that most of the business people speak English quite well and a number of them

take pride in having gotten part of their education in the United States. This all bodes well for Mexico and will help to make it advance rapidly. A feeling of friendship for Americans was universally shown.

We went on to Guaymas and put up at the Miramar Beach Hotel which is located on a beautiful bay just north of Guaymas. Here the accommodations were good and the rates reasonable, and the exchange of our dollars into Mexican pesos was also in our favor. Don't think for a minute that I am over enthusiastic when I say that the climate is ideal, that collecting is unexcelled and that sport fishing for marlin and sailfish is hard to beat anywhere else. At least such has been our experience from January to May of several years. During January of this year the thermometer in our brick cottage at Miramar never went above 70° F., and at night with the windows wide open it failed to get below 60 degrees. What do you Eastern people think of this for January? Is it any wonder that we could be out from morning till night in our shirtsleeves, wading, digging, collecting, sailing, or autoing to beaches farther off.

I have not bragged on the condition of Mexican roads, but in fairness will add that this year work is being done on all the roads I have referred to and that this summer will see the completion of the numerous culverts and concrete bridges now being built across the many "*vados,*" or dips, and small rivers between Hermosillo and the border.

About the people we came in contact with, and they were many and of different stations, we all formed favorable opinions. They were friendly and always willing to accommodate and aid us and that was a large factor in making our stays so pleasant. Among other things we took in a dance given in honor of one of the two contestants for queen of the annual fiesta soon to be held. It was as nice an affair as could be seen anywhere. The young people were jolly and well mannered and absolutely no liquor was indulged in. The floor manager told us that liquor drinking by dancers was inconceivable, and that anyone breaking this rule would be summarily ejected. The girls wore beautiful dresses many of which were flowered or spangled or lavishly embroidered, and some were said to be heirlooms dating back for generations.

But now back to business: We didn't go to Mexico so many

times just to see the country or even to observe the customs of the people; we went there primarily to study the marine life and to get specimens for our collections. We worked at that industriously, and as a result were able to bring back more than three hundred different species of which about three-fourths were mollusks. I will not attempt to give a complete list or even to mention very many, but will call attention to the four plates accompanying this. They show better than I can tell how we did our studying.

Plate 1, Conidae, shows ten rows of *Conus*, each row a different species and all taken last January within a few miles of Guaymas. The species figured on Plate 1 are:

1. *Conus princeps* L.
2. *C. purpurascens* Brod.
3. *C. virgatus* Rve.
4. *C. regularis* Sowb.
5. *C. comptus* Gld.
6. *C. mahogani* Rve.
7. *C. perplexus* Sowb.
8. *C. archon* Brod.
9. *C. gladiator* Brod.
10. *C. nux* Brod.

I think this is a record, for I have never seen or heard that all of them had previously been taken so far north.

Plates 2, 3 and 4 picture growth-series, and show these interesting gastropods from juveniles up through the developmental stages to the adults.

Melongena patula Broderip, shown in Plate 2, was found in numbers in the Miramar Lagoon, the young ones in shallow pools and the older ones well buried in the sand.

Strombus galeatus Swainson was the most difficult to get. It grows to a large size and is very heavy. The Mexicans call it "Concha." It stays outside of extreme low tides.

Fusus dupetithouarsi Kiener, in Plate 3, was found this year in outside sand bars, while on other trips it was observed only in muddy lagoons.

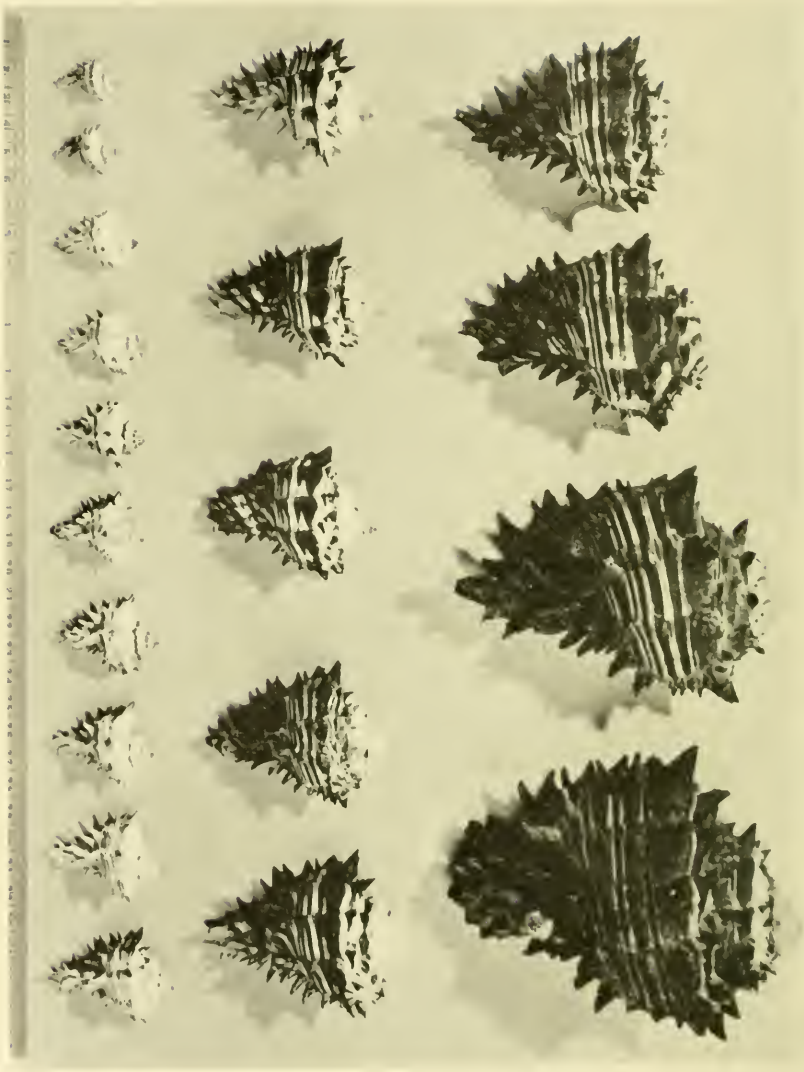
Fasciolaria princeps Sowerby, Plate 3, fig. 2, generally keep themselves in pretty deep water, but this year they were found in San Carlos Bay feeding on *Phyllonotus bicolor*, the beautiful murex which is so plentiful there.

Murex nigritus Philippi, plate 4. This series shows that the young are nearly white, something that has caused considerable confusion. Frequently you find the white ones classified as *Murex princeps*, which is an entirely different animal.

Conidae of Guaymas.

MELONGENA PATULA Broderip

FIG. 1, *Fusinus dupetithouarsi* Kiener.
FIG. 2, *Fasciolaria princeps* Sowerby.



MUREX NIGRITUS Philippi
mm, scale on left

We were all very keen hunting for the Olividae. They live in colonies and when you are lucky enough to find such a one, you can take many specimens. The large beautiful *Oliva incrassata* Solander is found in outside sandpits at extreme low tides, but never in the lagoons. Collectors consider it a prize. San Carlos Bay has more *Oliva venulata* Lam. than any other place we visited. *Olivella dama* Gray was found outside with *Oliva incrassata.* Thus the largest and the smallest live together. We were also lucky enough to find a few of the rare *Agaronia testacea* Lam. All olives live in the sand and they travel near the surface raising it like a mole. That makes it easy to locate them—if. . . .

It would not do to close without calling attention to the great quantity of bivalves found. They vary in size from almost microscopic to such large ones as *Spondylus limbatus, Dosinia ponderosa, Cardium elatum, Chama mexicana, Antigona multicostata, Arca grandis* and others. A few of those that are noted for beauty are *Chione gnidia, Anomia adamas* and the Tellinidae.

Some of our extra welcome discoveries were *Simnia quailii* Lowe (pink), and *Simnia aequae* Lowe (black). These we found on gorgonians in shallow water; something unusual, for gorgonians are generally so deep that you have to dredge or dive for them. The other rare find was *Heliacus radiatus,* which lives on or among the compound ascidians on rocks exposed only at very low tides. It has a peculiarly spirally tipped opereulum, and is classified with the architectonicas.

In a previous article in the NAUTILUS I mentioned the seasonal appearance of some species and the absence of others. This goes to show that it requires more than one trip to become fairly well acquainted with the fauna of a definite location, and the trips should be made at different seasons of the year to be most successful.

In 1929 to 1931 Mr. Herbert N. Lowe of Los Angeles, collected extensively along the west coast of Mexico and Central America, south to Panama, and the description by Dr. H. A. Pilsbry of the many new species found and the table of all the species taken is interestingly told in the Proceedings of The Academy of Natural Sciences of Philadelphia, Vol. LXXXIV, 1932, pages 33–144. All students of West Mexican Mollusks should read this.

OBSERVATIONS ON THE LOCAL MOVEMENTS OF *LITTORINA LITOREA* (L.) AND *THAIS LAPILLUS* (L.)

By RALPH W. D. DEXTER

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In connection with an ecological study of intertidal marine communities, preliminary experiments on snail movements were conducted during the summer of 1936. The purpose was to determine the general direction, rate, and range of movements of individual snails in their dispersal over the shore in order to understand more fully their role in community dynamics. *L. litorea* (L.), the English periwinkle, and *T. lapillus* (L.), the common rock snail, were chosen for study because they are the most significant of the herbivorous and carnivorous snails respectively of the intertidal hard-surface communities investigated. While many studies have been made on these species, nothing seems to have been published on their local movements.

When the tide was low, the snails were marked with a quick-drying red enamel paint without removing them from the rocks, and their locations were then mapped. During each succeeding day for a period of one week, and at irregular intervals thereafter, the distance travelled by each snail was measured in a straight line from the previous location, which represents the minimum radial distance travelled. After submergence in salt water over a period of several days the red paint lost its brilliant color, but it retained enough pigmentation to enable one to find and identify the marked individuals. In some cases they were found with difficulty and occasionally one was lost for a day or two. They were selected originally in small groups. Two groups of 5 individuals of *L. litorea* and two groups of 4 individuals of *T. lapillus* were marked. The groups were clustered on separate rocks at about the half tide level. The tidal interval is 11 hours and 14 minutes at the location of the experiment along the shores of a tidal inlet at Gloucester, on Cape Ann, Massachusetts.

During exposure the snails of both species were inactive, remaining attached in position with little or no movement. After submergence they became active and wandered about in various

directions and for varying distances. Their movement is very pronouncedly rhythmical, being controlled directly by the tidal flow and ebb, and for the most part is concerned with their feeding activities.

The specimens of *L. litorea* moved a daily average minimum distance of 22.2 inches. In recording directions of travel, each snail was plotted at the intersection of 4 equal sectors designated as upshore, downshore, left, and right quarters, the directions being those of the observer facing upshore. Averages are based upon the daily records of the first week of observation. The marked specimens of *L. litorea* moved in all directions. Those moving upshore averaged 23.3 inches each day. Downshore movements averaged 23 inches each day. Those moving to the left and right averaged 10.2 and 26.3 inches respectively. Four individuals at one time or another did not move at all over a period of at least 24 hours. Five days after one set of 5 had been marked (July 4), four individuals were 38, 49, 114, and 142 inches from their original locations. At that time, nine days after the other set had been marked, three individuals of the second group were 13, 39, and 56 inches away from their original positions. Nine days later (July 13), 4 snails of this set were 50, 52, 94, and 151 inches away from the original locations, and 17 days still later (July 30) the only individual which could be found was at a distance of 124 inches. The periwinkles did not follow any pattern, given direction, or uniform rate movement. Many reversed their directions at various intervals of time, and their movements seemed to be entirely fortuitous.

At the time of spring tides great quantities of *L. litorea,* especially small specimens, were observed to move upshore and literally coat the rocks between the neap and spring high-tide lines. Following the spring tides they migrated downshore again.

T. lapillus averaged 10.4 inches of total movement per day. Upshore movements averaged 19 inches while those moving downward averaged 10.5 inches. Snails moving into the right sector averaged 7 inches; none was observed to move into the left quarter.

Five individuals at one time or another remained stationary over a period of 24 hours. Eighteen days after one set was

marked (July 13), two individuals were 22 and 34 inches away from the original location. Sixty days later (September 11), or eleven weeks after the beginning of the experiment, one snail was 62 inches from its original position. Twenty-six days after the other set was marked, (July 30) two individuals were 22 and 28 inches away. Twenty-five days later (Aug. 24) two were 10 and 18 inches away; another eighteen days later (Sept. 11), or nearly eleven weeks after the snails were marked, three were only 6, 7 and 30 inches away respectively.

T. lapillus, which feeds principally on *Balanus balanoides* (L.) and *Mytilus edulis* L., showed a tendency to remain on barnacles, in crevices, and under seaweeds for long periods and to remain within a restricted locality. In general it did not travel as much nor as extensively as *L. litorea* which feeds chiefly on algae, both microscopic and macroscopic.

LIFE CYCLE OF LYMNAEA STAGNALIS COMPLETED AT ROOM TEMPERATURE WITHOUT ACCESS TO AIR

By LOWELL E. NOLAND and ELEANOR REICHEL

University of Wisconsin

It has been known for some time that pulmonate snails may, under certain conditions, become water-breathing. In fact *Planorbis cristatus* is said to have its lung permenently filled with water (Willem, 1895; von Buddenbrock, 1924); and *Planorbis corneus* is reported to have developed accessory gills in its lung cavity (von Buddenbrock, 1924). It has been further claimed by Precht (1939) that *Lymnaea stagnicola* assumes purely cutaneous, aquatic respiration at a temperature of 5° C. or below. According to Cheatum (1934) *Helisoma campanulatum smithii, H. antrosum percarinatum, Lymnaea emarginata angulata* and *Physa sayi crassa* are probably able to complete their life cycles and reproduce normally without coming to the surface for air. Forel and Du Plessis (1874) and Brot (1874) reported *Lymnaea abyssicola* living at depths of 25 to 250 meters in Lake Geneva, Switzerland. When collected, their lung cavities were filled with water and, living at such depths, they could

hardly have made contact with the surface at any time during their life history.

Von Siebold (1875) records having seen, in deep water, colonies of *Lymnaea auricularia* which, during the period of his observations, were never observed to visit the surface. Fresh-water pulmonates that spend the winter under the ice are probably forced to depend to a large extent, if not exclusively, on cutaneous respiration. Willem (1896) showed that *Lymnaea* and *Planorbis* could be kept submerged for long periods in well-aerated water, but died in a few hours when immersed in water that had been boiled and protected from contact with air. In the land snail *Helix*, with the shell removed and the body kept submerged in normal saline, cutaneous respiration has been shown to exceed pulmonary respiration (Courtois and Duval, 1927; Raffy and Fischer, 1931). Cheatum (1934) showed that nine species of fresh-water snails can withstand enforced and prolonged submersion (62 days). The percentage of survival was less in warm water (21.6° to 25.6° C.) than in cooler water (11° C.). Removal of the air from the lung cavity likewise reduced the percentage of survival.

H. B. Baker (1912) reported six species of pulmonates from Douglas Lake, Michigan, including *Lymnaea stagnalis perampla* Walker, *L. emarginata angulata* (Sowerby), *Physa ancillaria parkeri* (Currier), *P. bicarinatus portagensis* Baker, *P. b. percarinatus* Walker, and *Planorbis campanulatus smithii* Baker, which according to his observations "appear to be all deep water forms and have apparently become adapted to breathe water instead of air." He suggested the possibility that the water-breathing habit had even affected the body form of some of the species to the extent of modifying the shell type of *Lymnaea stagnalis appressa* toward that of *L. s. perampla* and the shell form of typical *Physa ancillaria* Say toward that of *P. a. parkeri*. Two years later (Baker 1914) he recorded further observations on the water-breathing habits of Douglas Lake snails, in the course of which he noted that the adults of *Physa ancillaria parkeri* "were so completely habituated to breathing water that when placed in small aquaria, they died soon after exhausting the air in the water, without ever attempting to come to the surface to breathe; although when once taught to breathe air,

by the simple method of exposing them out of water until the water in their lungs partially evaporated or was otherwise replaced by air, they could be kept in a small dish for several months and would come to the surface regularly like any ordinary, air-breathing form."

In the course of other studies on the biology of *Lymnaea stagnalis appressa* Say, pursued in this laboratory, it occurred to us that it would be interesting to find out whether this snail, which is normally air-breathing, could be grown through a complete life cycle in the laboratory at room temperatures without ever being permitted to come to the surface for air.

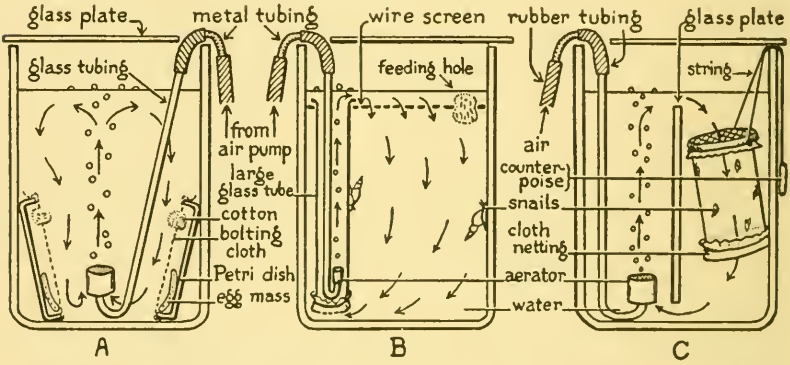

Fig. 1. Diagrams showing containers used to provide the egg masses and growing snails with aerated water while at the same time preventing access to the surface.

Accordingly several newly deposited egg masses were collected, on Feb. 28 and Mar. 1, 1940, and placed in shallow glass containers (one member of a Petri dish pair). Three such dishes were set up, and each was covered with coarse-meshed bolting cloth, in which there was a small feeding hole plugged with cotton that could be removed at feeding times. These dishes were submersed in water in a large glass container kept at room temperature in the laboratory. All air bubbles were carefully removed after immersion. The dishes were placed near an air releaser which maintained a constant current of aerated water past the bolting cloth covers of the dishes, but not so near that any bubbles from the air releaser would come in contact with the cloth (Fig. 1 A).

The room in which the snails were kept had a thermostatically controlled temperature, which was normally near 20° C., except in the summer when a somewhat higher temperature was reached (up to 34.4° C. at one time, as will be mentioned later).

Hatching occurred within a month (Mar. 28 to Apr. 4). The young snails were fed small pieces of tender green lettuce, which had been previously immersed in water and freed of all air bubbles. A sample of water taken from the inside of the Petri dish gave, with the micro-Winkler method (Lund, 1922), a reading of 1.8 cc. dissolved oxygen per liter, as compared with 2.5 to 3.1 cc. in the outside water, indicating that the utilization of oxygen inside the dish was greater than its replacement by the circulation of the water.

On July 12, about three months after hatching, all the snails in one of the dishes died, apparently due to depletion of the oxygen supply past the point of toleration. These snails had shell lengths of 9.0 to 17.5 mm. at the time of death, approximately ten weeks after hatching. In this same period of time, normal snails fed on lettuce and allowed access to air ordinarily reached a shell length of 20 to 30 mm. under the culture methods employed at that time in the laboratory. Evidently, therefore, there was a considerable retardation of growth in spite of the fact that a small excess of food (lettuce) was regularly provided.

After the death of the snails in the one dish, those in the remaining two dishes were transferred to more commodious quarters, a battery jar six inches in diameter and eight inches high, equipped, as shown in Fig. 1 B, to provide for better aeration of the water but, as before, preventing access to the surface. In these and in all other transfers (i.e., when water was changed, at intervals of one to two weeks), care was taken to keep the snails immersed in water at all times during the transfer, so that there would be no possibility of their taking air into their lung cavities at this time. In young snails, the shell is sufficiently transparent to detect the presence of air in the lung, and the snails were regularly checked when the transfers were made to see if air was present. Another check was possible because snails with no air in the lung are considerably heavier than water and sink rapidly when allowed to fall through the water; snails with air in the lung either float or sink rather slowly. At no

time was air observed in the lungs of any of the snails except the two that escaped as mentioned below.

On Dec. 26, 1940, nearly nine months after hatching, the first egg mass was found in the jar. Normally under our laboratory cultural conditions, snails start laying about three or four months after hatching. Evidently, therefore, submersion had more than doubled the time required to reach sexual maturity and lay eggs. On Jan. 8, 1941, another egg mass was found, and on Jan. 9, four more. Other egg masses were laid at intervals up to April 11, when four of the snails were still alive. At this time, two of the animals escaped, through an opening caused by an undetected bend in the wire barrier, and took air into their lung cavities. These were discarded, and the two remaining ones retained until their death on May 31, 1941, at an age of approximately 14 months. In our usual laboratory cultures, snails of this species commonly live from 12 to 18 months. At death, the shell length is usually between 40 and 50 mm., as compared with 33 and 34 mm. respectively in the two oldest submersed snails. During most of their adult life, the submersed snails had a dull, leaden-gray color in their exposed fleshy parts, as compared with the light brownish or olive shade of normal animals.

Eggs laid by the submersed snails about Apr. 1, 1941, were placed on April 12 in containers made by removing the bottom from a small drinking glass and covering both ends with cloth netting (organdy for the earlier stages, mosquito netting for the older ones). These containers, suspended in a current of water maintained by aerators (see Fig. 1 C), provided better circulation of aerated water than the Petri dishes used in the first experiment. By May 31, at an age of about five weeks, the shell lengths of the young snails varied between 3 and 10 mm., only slightly less than those of snails of the same age in the regular laboratory cultures. In the hot weather of midsummer of 1941, when, in the absence of the writers the care of the cultures was entrusted to a laboratory assistant, the culture was lost. On July 29, 1941, about the time that the snails in the culture died, the temperature of the laboratory air reached 34.4° C., and the temperature of the cultures in the laboratory

went above 30° C. (a reading at 8:30 a.m. on that date gave a temperature of 30.5° C.). Subsequent work by Dr. C. M. Vaughn (not yet published) has shown that, even in the case of snails allowed access to air in well-aerated laboratory cultures, temperatures of this magnitude result in some mortality.

The observations made in the course of these experiments on submersed snails show: (1) that *Lymnaea stagnalis appressa* can be grown through a complete life cycle in laboratory cultures at room temperatures without having access to the air; (2) that the growth of the snails under such conditions is somewhat retarded as compared with that of normal animals, but that in time they can reach maturity, lay viable eggs, and attain a size and life span only slightly less than that of normal snails.

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TWO NEW ORINOCO UNIONIDS, WITH NOTES ON UNIO GRANADENSIS LEA AND U. PATULUS LEA

By J. P. E. MORRISON [1]

Some time ago the Rev. W. H. Fluck of Newfane, Vermont, sent a few Orinoco Unionids to the United States National Museum for determination. This material, representing the two new species described herewith, serves to accentuate our very limited knowledge of the molluscan fauna of the Orinoco basin.

Castalia orinocensis, new species. Plate 5, figures 1–4.

Shell subrhomboid, elliptical, slightly inequilateral, moderately compressed; sculpture of numerous, flat, radiating ridges, crossed by narrow, concentric growth ridges; anterior end evenly rounded. Posterior dorsal slope obliquely truncate; posterior ridge moderate, rounded, ending in a narrowly rounded point a little above the base; dorsal line arched; ventral margin slightly rounded; epidermis olivaceous; laterals long, slightly curved; pseudocardinals irregularly radial, proportionately massive, not linear; nacre white, iridescent behind; anterior adductor, protractor, and retractor cicatrices completely confluent.

The holotype, U.S.N.M. No. 522000, was received from Rev. W. H. Fluck, collected on the Orinoco River at Maipures, U. S. Colombia, and measures: Length, 36.6 mm.; height, 24 mm.; diameter, 17.2 mm.

The greater degree of inflation, completely confluent anterior muscle scars, and the subradial (massive) pseudocardinals will easily distinguish *C. orinocensis* from the other members of the group of *Castalia multisulcata* Hupé.

Diplodon flucki, new species. Plate 5, figures 5–9.

Shell of medium size, subsolid, elongate-rhomboid to long elliptical, inflated; posterior ridge rounded or biangulate, ending posteriorly in a biangulate point a little above the base line; anterior end regularly rounded; dorsal line slightly arched; ventral margin slightly curved; the posterior end obliquely truncate, meeting the base line at the post basal biangulation; epidermis olivaceous. Beaks little inflated, radially sculptured with very delicate, pinched up ridges, minute and curved down-

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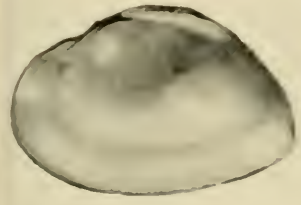

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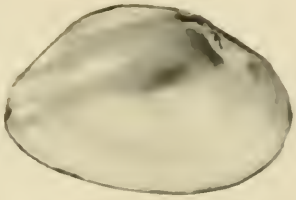

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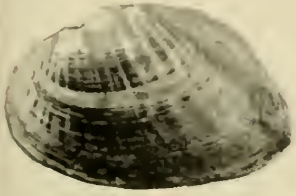

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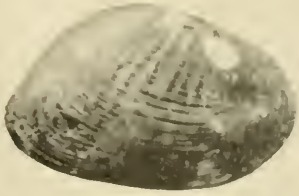

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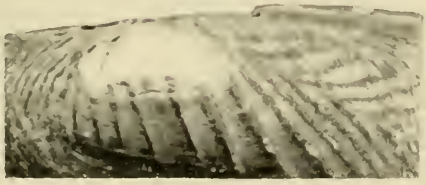

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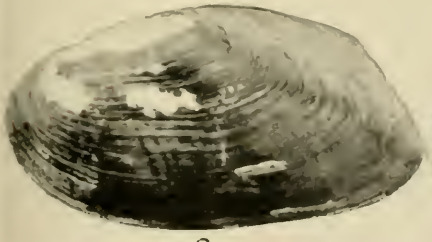

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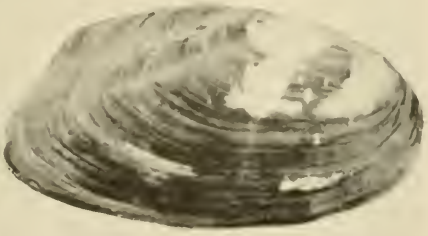

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Figs. 1–4, *Castalia orinocensis*, holotype. Fig. 5, *Diplodon flucki*, paratype, beak sculpture × 5. Figs. 6–9, *Diplodon flucki*, holotype.

Fig. 1, *Hua telomaria* × 3. Fig. 2, *Hemimastra lungi*, holotype × 3. Fig. 3, *Sermyla kowloonensis*, holotype × 3. Fig. 4, *Wanga henriettae* × 1½. Fig. 5, *Amphidromus pattinsonae*, type × 2. Fig. 6, *Drymaeus perdoctorum*, type; figs. 7–9, paratypes. Fig. 10, *Drymaeus bourgeoisae*, type. Fig. 11, *Ensis minor*. Fig. 12, 13, *Ensis minor megistus*, outer and inner views of paratype and type.

ward anteriorly, more distant and straight medially, and strikingly divaricate at a 45° angle just above the posterior ridge posteriorly; the beak sculpture extends only over the umbonal portion of the shell, up to a shell length of about 15 mm. Sculpture finely concentrically striate, with minute traces of radial sculpture over the disc. Hinge teeth distinctive, the hinge line narrow, pseudocardinals lamellar, compressed, two in each valve, the (upper) anterior one in the right valve small, thin, low; the posterior long, high, and triangular; the anterior one in the left valve low, long, triangular; the posterior high, triangular, being practically a portion of the interdentum. The two high triangular posterior pseudocardinals fit into depressions in the hinge line opposite, so that the ventral aspect of the hinge line is zigzag in this part. Nacre white, beautifully iridescent; the cicatrices are moderately deep, the posterior confluent, the anterior deeper, with the anterior retractor a deep, distinct pit on the bottom of the pseudocardinal buttress. Dorsal muscle scars a plainly marked diagonal row in the middle of the shallow cavities of the beaks.

The holotype, U.S.N.M. No. 521998, was collected from the Orinoco River above Munduapo, Venezuela, and measures: Length, 52.3 mm.; height, 28.3 mm.; diameter, 22.6 mm. One of two paratypes, U.S.N.M. No. 521999, exhibits almost perfect (uneroded) beak sculpture; it is a young shell only 26 mm. in length.

The finely concentrically striate sculpture, with traces of radial sculpture, and the peculiarly zigzag hinge line produced by the meshing of the two thin, high, triagular pseudocardinals, indicates a relationship with *D. suavidicus* (Lea) from the Amazon basin. It differs from that species in being more elongate, a little more inflated and more pointed behind. The beak sculpture of *D. flucki* (fig. 5) differs from that of *D. suavidicus* in the straightness of the medial ridges, not converging; and the more definitely clean-cut divaricate wrinkles on the posterior slope; also the fine anterior riblets are straight in *suavidicus,* regularly curved downward in *flucki.*

Unionid Notes

Some years ago Wm. B. Marshall noted in Ms. that *Unio granadensis* Lea (Proc. A.N.S.P. 12: 95, 1868) was a homonym of *Unio granadensis* Conrad (Proc. A.N.S.P. 7: 256, 1855), but did not publish the fact. In recognition of his discovery of the untenable use of Lea's name, the species is hereby designated *Micronaias marshalli,* new name for *U. granadensis* Lea 1868, from Lake Nicaragua.

The type of *Unio patulus* Lea 1829 (figured in Obs. 1: 55: pl. 12. fig. 20) has been found. This specimen, U.S.N.M. No. 84760, is a very characteristic member of the species usually known as *Pleurobema lesleyi* Lea (Proc. A.N.S.P. 9: 306, 1860). In fact it had been included under the name *lesleyi*, but part of the original ink writing, "*patulus*," still shows on the interior of the left valve. The name *Pleurobema patula* must replace *P. lesleyi*. It must be removed from the synonymy of *P. clava* Lam., as a glance at the non-clavate dorsal outline type figure will demonstrate. The uncertainty about this species was implied by Simpson in questioning the placement under *clava*. The type locality "Ohio" (T. G. Lea) may be questioned; it probably should be read as Ohio Drainage,—i.e. Kentucky, as is known for "*lesleyi*."

A NEW AMPHIDROMUS FROM BURMA

By TOM IREDALE[1]

Mrs. T. Pattinson, when traveling through Burma, collected a very beautiful landshell on a bush on the side of the road to Maymyo, about 40 miles northeast of Mandalay. This shell she has presented to the Australian Museum, and as it appears to represent an unnamed species it is here described as

AMPHIDROMUS (SYNDROMUS) PATTINSONAE sp. nov. Plate 6, fig. 5.

Shell sinistral, elongate, imperforate, smooth, glossy. The tip is dark purple, succeeding whorls whitish washed with green, last whorl yellowish green, umbilical area crimson lake; banded throughout with two or three bands of brownish lake, the bands suggesting a series of coalesced blotches. Whorls 5½, slightly convex; suture linear. Columella slightly receding. Aperture oval, angulate below, peristome thin, immature. Length 28 mm., breadth 12.5 mm.

The species appears to be allied to *A. cruentatus* Morelet (Séries Conchyl IV, p. 264, pl. 13, fig. 5, 1875) as figured by Pilsbry (Man. Conch. 2 Ser. Vol. XIII, p. 187, pl. 60, figs. 39, 40, 1900) in its crimson lake umbilical area, but it is much narrower and more elegantly shaped and the coloration separates it immediately.

[1] By permission of the Trustees of the Australian Museum, Sydney.

HELICOSTYLA FROM THE TALAUD ISLANDS, MOLUCCA ISLANDS, EAST INDIES

By WILLIAM J. CLENCH

The Talaud Islands (Tular and Talauer are various spellings) compose a small archipelago that is situated about midway between Mindanao Island, Philippines and Halmahera (Gilolo) in the Dutch East Indies. They are included in the Molucca group of these latter islands and are approximately 120 miles N.E. of Halmahera.

During the winter cruise of the yacht "Cheng Ho" in 1940, Dr. and Mrs. David Fairchild collected a large series of three species of *Helicostyla* at Arangkaa, Karakelong Island, Talaud Islands.

The importance of locating *Helicostyla tukanensis* Pfr. on this island corrects what has been a rather persistant error since the original citation of Pfeiffer.

In 1871, Pfeiffer described in the Malakozoologische Blätter 18, pp. 119–124, six new land shells, five of which he received from J. H. Thomson of New Bedford, Mass. Thomson may have collected this material as he had been a ships master, or it is equally possible that he may have received his specimens from some sailor friend who had visited the East Indies. At any rate, material was credited to both Tukan Bessi Island (off the southeastern peninsula of Celebes Island) and from Tular Island. The former is 750 miles to the south of Tular [Talaud] Islands, there appears to have been some question regarding the data of certain of these new forms as Pfeiffer had indicated two of them with question marks.

The present collection straightens out a few of these uncertainties besides correcting an anomaly, the existence of a few species well outside the known range of other members of the genus.

The locality for the four following species is Arangkaa, Karakelong Island, Talaud Group, Molucca Islands.

HELICOSTYLA (CALOCOCHLEA) TUKANENSIS Pfeiffer

Helix tukanensis Pfr. 1871, Malak. Blätt. 18, p. 122 (Tukan Bessi Island); *ibid.*, 1872, Novit. Conch. 4, p. 72, pl. 121, fig. 5–9.

Cochlostyla (*Calocochlea*) *tukanensis* Pfr. Pilsbry 1891, Man. Conch. (2) 7, p. 132, pl. 29, fig. 7–9, 12.

Pilsbry (i. c.) gives "Pular Islands" on the authority of Horn. This is apparently a mis-spelling or an alternative for Tular.

Helicostyla (Corasia) subpuella Pilsbry.

Helix lais Pfr. var. 1875, Novit. Conch. 4, p. 114, pl. 126, fig. 6–7 (Tukan Bessi Island).

Cochlostyla (*Corasia*) *puella subpuella* Pils. 1891, Man. Conch. (2) 7, p. 121, pl. 24, fig. 19–21, 24, 26 (Basilan, Philippines; Tukan Bessi Island).

This species was not cited among the new species described in the Malak. Blätt., but was figured and given the locality of Tukan Bassi in the Novit. Conch. (l. c.) as a variety without name, which was later described by Pilsbry. This was another one of the Thomson species which was in error as to locality. Pilsbry's record of Basilan Island, Philippines is also open to question.

Helicostyla (Corasia) physalis Pfeiffer.

Helix physalis Pfr. 1871, Malak. Blätt. 18, p. 123 ("Tular Island"—Thomson); *ibid.*, 1872, Novit. Conch. 4, p. 73, pl. 121, fig. 10–11.

Cochlostyla (*Corasia*) *physalis* Pfr. Pilsbry 1891, Man Conch. (2) 7, p. 115, pl. 27, fig. 2–3 (Tular [Talaur?] Island). This is the only species properly localized by Thomson.

Obba marginata Müller.

Helix marginata Müller, 1774, Vermium Terr. Fluv. 2, p. 41. —Pfeiffer 1852, Conchy.-Cab. (2) 1, pt. 12, sec. 2, p. 69, pl. 78, fig. 7–9 (Philippines).

This species as well as two of the others listed above, was wrongly localized by Thomson. In his paper on the land shells of the Celebes (Malak. Blätt. 20, p. 171, 1873) von Martens queries the locality of Tukun (or Tufun?) Besi for the specimens which he had received from Thomson. Reading between the lines, it would appear that Von Martens was having trouble

with Thomson's handwriting. Von Martens assigns it, with a query, to the Sulu group of islands in the Philippines. The present material, however, fixes the locality (of Thomson's material) as the Talaud Island group. The species appears to be widespread in the Philippines and not localized on any one island.

TWO NEW GENERA, TWO NEW SPECIES, AND TWO NEW NAMES OF CHINESE MELANIIDAE

By SUI-FONG CHEN

Scholar of China Institute at Johns Hopkins University

In preparing an annotated catalogue of the Chinese Melaniidae, two genera and two species were found to be undescribed. Also, two described species were found to be in need of valid names. Since publication of this catalogue has been delayed for an indefinite time, I think it is best to extract the new things and publish them separately, in order to make them available to other workers.

I wish here to express my appreciation to the authorities of the United States National Museum for the opportunity to make these studies of their collections, and especially to thank Dr. Paul Bartsch for his most kind guidance of my work on this material.

Genus Hemimitra Swainson 1840

Hemimitra tangi, new species, Pl. 6, Fig. 2.

Shell small, solid, ovate-conic, dark brown. The interior of the aperture is bluish white. Nuclear whorls eroded. Postnuclear whorls inflated, strongly rounded and marked with incremental lines. The spiral sculpture consists of microscopic threads. The last whorl which constitutes nearly the whole length of the shell, is inflated, with strongly rounded periphery and has a narrow dark band at the summit. The suture is moderately constricted. Base short, well rounded. Aperture pyriform; peristome simple, thin; parietal wall covered with a thin callus; columella concave and nearly vertical. The operculum is thin, corneous having 2.3 turns with a subcentral nucleus. The radula has the formula: 3–1–3 : 2–1–5 : 6 : 8.

The type, U. S. N. M. cat. No. 499701, was collected by Dr. C. C. Tang in Kiang-yang, northern Fukien Province, and has the following measurements: 2.4 whorls remaining; length 12.4 mm.; diameter 8.4 mm.; aperture length 7.5 mm.

Two additional specimens from the same source yield the following information:

Whorls	Length (mm.)	Diameter (mm.)	Aperture length (mm.)
3.0	10.6	7.8	6.9
2.2	8.5	5.9	5.5

This species resembles Hemimitra terminalis (Heude), but has only one narrow spiral brown band at the summit.

Genus Sermyla H. and A. Adams, 1854

Sermyla kowloonensis, new species, Pl. 6, Fig. 3.

1887. *Melania sculpta* Gredler, Mal. Bl. (n.s.), 9: 163 (not *M. sculpta* Souleyet).

Shell small, solid conic, olive brown throughout. Nuclear whorls eroded. Post-nuclear whorls 4.4, convex, and marked by strong protractive axial ribs of which 12 occur on the penultimate and the last whorls; the ribs terminate at the periphery of the whorl. The spiral sculpture consists of two threads of which one occurs on the summit and the other on the periphery of the last whorl. Suture well impressed. Periphery well rounded. Base short, strongly rounded, and marked by 7 spiral threads. Aperture elliptical; peristome thin; parietal wall covered with a thin callus; columella concave.

The type, U. S. N. M. cat. No. 48041, yields the following measurements: length 8.8 mm.; diameter 4.5 mm.; aperture length 4.5 mm. Its locality is Kowloon, on the mainland opposite Hong Kong.

This species is very closely related to *S. sculpta* Souleyet, but differs in being broader and possessing fewer, more distinctly protractive axial ribs.

Genus Wanga, new genus

Shell elongate to subulate, whorls more or less convex or slightly flattened. The sculpture consists of axial riblets and spiral cords crossing each other and forming strong nodules, which are much stronger than the intervening sculpture. Aper-

ture ovate, somewhat expanded at the base. Genotype: *Melania henriettae* Gray 1834. Pl. 6, Fig. 4.

The name of this genus is derived from the Chinese word for fish-net, in description of the sculpture. In addition to the genotype, this group includes: *Wanga dulcis* (Fulton) 1904; *Wanga hsüi,* new name for *Melania turrita* Hsü 1935, not Klein 1846; *Wanga lauta* (Fulton) 1904; *Wanga napoensis* (Hsü) 1935; *Wanga reticulata* (Lea) 1850; *Wanga scrupea* (Fulton) 1914, and the variety *scrupea debilis* (Fulton) 1914.

Genus Hua, new genus

Shell rather small, elongate-ovate, whorls smooth, somewhat flattened or only slightly convex. Aperture ovate, with an acute angle above; lip thin. Operculum with a subcentral nucleus. Radula rather long, the central tooth broader than high with a central cusp and three cusps on each side; the lateral tooth with a rather long, narrow appendage and two or three side cusps on each side of the main cusp; marginals rather long and narrow, broadening at the cutting edge which bears 5 to 8 cusps. Genotype: *Melania telonaria* Heude 1888. Pl. 6, Fig. 1.

The name of this genus is derived from the Chinese word for smooth, in allusion to the sculpture of the majority of members of the group. In addition to the genotype, this genus includes: *Hua diminuta* (Boettger) 1887; *Hua friniana* (Heude) 1888; *Hua heudei,* new name for *Melania orcadarum* Heude 1890; not Heude 1888; *Hua hongkongiensis* (Brot) 1874; *Hua joretiana* (Heude) 1890; *Hua kweichowensis* (Chen) 1937; *Hua leprosa* (Heude) 1888; *Hua orcadarum* (Heude) 1888, not Heude 1890, with *Melania naiadarum* Heude 1890 as a synonym; *Hua praenotata* (Gredler) 1884, and the variety *praenotata intermedia* (Gredler) 1885; *Hua protea nura* (Bavay and Dautzenberg) 1910; *Hua schmackeri* (Boettger) 1886; *Hua toucheana* (Heude) 1888; and *Hua vultuosa* (Fulton) 1914.

COMMENTS ON F. A. SCHILDER'S "CYPRAEACEA FROM HAWAII," AND SCHILDER AND SCHILDER'S "PRODROME OF A MONOGRAPH ON LIVING CYPRAEIDAE"

By WILLIAM MARCUS INGRAM

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F. A. Schilder (1933, Bernice P. Bishop Museum, Occ. Pap., vol. 10: 3, pp. 3–22) and F. A. Schilder and M. Schilder's (1939, Proceedings of the Malacological Society of London, vol. 23, pt. 4, pp. 119–231) have included inaccurate data concerning Hawaiian *Cypraeidae*. In order to clarify such erroneous data this paper is written.[1]

Schilder and Schilder (1939, op. cit., p. 130) make a statement concerning "ecological varieties" of *Cypraea semiplota* Mighels which warrants comment. They agree with the writer (Ingram, 1936, The Nautilus, vol. 50: 2, pp. 51–52), that *Cypraea annae* Roberts and *Cypraea polita* Roberts are merely synonyma of *C. semiplota*. Schilder and Schilder (1939, op. cit., p. 130) regard the so-called *"annae"* and *"polita"* as ecological varieties. They state, "There are three distinct ecological varieties: the small oblong *semiplota*, . . . the callous dilated *annae*, . . . and the large pellucid *polita*, . . . with the extremities more produced and acutely curved even in broad specimens; intermediate shells are less frequent; *annae* and *polita* seem to have not yet been collected in the Leeward Islands." Three ecological varieties do not exist in the species *C. semiplota* Mighels. The writer has several times collected the so-called "ecological varieties" under similar conditions in areas from 10 to 30 square feet on the Waikiki reef, Honolulu, Hawaii. On the reef at Kupikipikio Point, Oahu, the writer has collected *"annae"* and *"polita"* living side by side beneath the same block of coral rock. The shell forms of *C. semiplota* seem to this writer to be merely individual variations. If the three forms, "ecological varieties," were truly found occupying separate ecological nitches they could then be considered as ecological variants; however they are not so found.

[1] References are repeated in the bibliography with their full titles.

Individuals of *"annae"* and *"polita"* are in the writers collection from the Leeward Islands of the Hawaiian Archipelago.

Schilder and Schilder (1939, op. cit., p. 220) state that the *Cypraea cruenta* of Gray reported by Ostergaard (1928, Bernice P. Bishop Museum, Bull., 51, p. 28) and by Ingram (1937, The Nautilus, vol. 50: 3, p. 78) seems to be *Cypraea rashleighana* Melvill. Ostergaard (1928 op. cit.) and Ingram (1937 op. cit.) in referring to Hawaiian Cypraeidae did not list a *cruenta* Gray; their *cruenta* was that of Gmelin.[2] In any event *C. cruenta* Gmelin does occur in the Hawaiian Islands, and the above writers could not have failed to distinguish *cruenta* from *rashleighana* Melvill. The above papers by Ostergaard and Ingram were based on personal collecting and on the collections of men who have collected in the Hawaiian Islands for over twenty years, namely, Mr. David Thaanum, the late Mr. L. A. Thurston, and Mr. Ted Dranga, all of Honolulu.

F. A. Schilder (1933, op. cit.) lists fourteen species of Cypraeidae from the Hawaiian Islands, one of these being a new species, *Cypraea waikikiensis* (Schilder). In splitting the genus *Cypraca* in this paper Schilder placed his new species in the genus *Palmadusta*. This species of Schilder's is probably based on two odd specimens of *Cypraca fimbriata* Gmelin. The holotype drawings are quite unmistakingly those of *C. fimbriata*. Thus the species, *waikiensis*, should be considered a synonym of *C. fimbriata* Gmelin.

In the (1933, op. cit.) paper Schilder lists a *Palmadusta unifasciata* Mighels, a synonym of *Cypraca fimbriata* Gmelin. In the Prodrome (1939, op. cit.) The Hawaiian *C. fimbriata* is placed as a subspecies, *unifasciata* Mighels, under *C. fimbriata*, the Schilders finally considering that *P. unifasciata* is not a distinct species from *C. fimbriata*.

The probable ancestral type to the endemic Hawaiian *Cypraca tessellata* Swainson and *Cypraca sulcidentata* Gray is *Cypraca arenosa* Gray, Ingram (1937, op. cit.) and Ostergaard (1928, op. cit.), yet Schilder and Schilder (1939, op. cit.) place *Cypraca tessellata* in a separate genus, *Pustularia* Swainson, including such unrelated forms to *C. tesselata* as the closely related *cicercula* Linnaeus and *globulus* Linnaeus, etc. They place *C. are-*

[2] Illustrated in G. B. Sowerby, Thesaurus Conchyliorum, pl. 23, figs. 185, 187, 1870.

nosa and *C. sulcidentata* as they should, together, in the genus *Cypraea*. Schilder and Schilder (1939, op. cit., p. 126) state, "The Hawaiian *tesellata* . . . evidently is allied to *globulus*, though differing much in size and colour." Any one familiar with the *Cypraeidae* would conclude that these forms are as distantly related as *C. moneta* Linneaus and *C. aurantium* Martyn.

In Schilder's (1933, op. cit.) paper he places *Cypraea carneola* Linnaeus in the genus *Lyncina*. In this paper he comments on the large size of *carneola* and states that the form is cylindrical. In their Prodrome the Schilders (1939 op. cit.) place *craneola* in the genus *Cypraea* and in the subgenus *Lyncina*. In the Schilders' (1939, op. cit.) Prodrome they consider the large, cylindrical *carneola* as a separate species, *leviathan*, and list the form *propinqua* Garrett, which is merely an ovate individual variant, not mentioned in Schilder's (1933, op. cit.) paper as the subspecies of *carneola* found in Hawaii. Schilder and Schilder (1939, op. cit.) concerning the large, cylindrical *carneola* state, ". . . the large cylindrical ectotype of this race *propinqua* has become a distinct species, *leviathan*, as the divergence increased by development of some additional characters." They give the distribution of *C. leviathan* (Schilder & Schilder) as E. Polynesia to Gambier Island, Cook Island, Hawaii and French Frigate Shoals. The writer has a number of large and small specimens of *Cypraea carneola* Linnaeus from the Islands of Maui and Oahu, Hawaiian Islands; collections of living and dead shells of the individual variant, *propinqua*, have been made on Rabbit Island off the shore of Oahu living together with the cylindrical individual variant. Under the circumstances it seems that *C. leviathan* (Schilder & Schilder) is merely a synonym of *C. carneola* Linnaeus. Shell intergradations from the cylindrical to ovate variants in Hawaiian specimens also indicate the *leviathan* is only to be regarded as a synonym of *C. carneola*.

Of the species listed as occurring in the Hawaiian Islands by the Schilders (1939, op. cit., p. 197 footnote, p. 220), the Schilders have only examined fifteen species represented as collections made in Hawaii. With such incomplete information, and never having collected in Hawaii, it hardly seems possible that these workers can draw conclusions concerning ectotypes, ecological varieties, and question identifications of men who have been

established in Hawaii for twenty years, and whose collecting ability and scientific collecting procedure is known through conchological circles.

In the Prodome the Schilders (1939, op. cit., p. 184) list a *Mauritia maculifera* Schilder which is the well-known *Cypraea reticulata* of Martyn. In the Prodrome (1939, op. cit., p. 184) they state that it is found at French Frigate Shoals; (1930, op. cit., p. 220) they credit this species to the Hawaiian Islands with a distribution from French Frigate Shoals to Midway Islands and then from Hawaii to Kauai. They list a *Mauritia depressa* Gray (Gray's *Cypraea intermedia*), as occurring in the Hawaiian Islands. This species is listed as occurring from Hawaii to Kaui. There are no authentic collections of this species from the Hawaiian Islands. The Schilders have added confusion to authentic records of Hawaiian Cypraeidas; on page 184 of the Prodrome they state, "It is rather difficult to state the exact frequency of *maculifera* . . . , as it has mostly been confounded with *depressa* by former writers." The Schilders (1939, op. cit., p. 220) say that *depressa* is found occurring in moderate frequency in Hawaii. Apparently they did not examine the specimens of this species, but base their "moderate frequency" data from unreliable literature.

Schilder (1933, op. cit., p. 13) makes a rather startling statement concerning *Cypraea isabella* Linnaeus, listed by Schilder as *Basilitrona isabella* Linnaeus, "All shells collected in LA [Laysan Island] and FK [French Frigate Shoals] are *controversa* [a name applied to *isabella* by Gray]; 1X [one specimen] from PH [Pearl and Hermes Reef, Southeast Island] and 2X [two specimens] from PG [Pearl and Hermes Reef, Grass Island] also belong to *controversa* and are rather calcified, whereas the typical *isabella* from PH and PG are more or less bleached on the shore, but never calcified: therefore *controversa* evidently lives in different conditions." This statement is rather an interesting hypothesis for one to make who have never collected in the Hawaiian Islands, and especially when one considers that this observation is apparently based on beach shells, the statement is not very profound. Schilder goes on to state, "The variety *controversa* is much larger, broader, higher, and more callous than the typical *isabella* . . . , but the number of teeth is increased only proportionately to the length of the

shell." It so happens that the environment for the so-called *controversa* and for *Cypraea isabella* ss. may be identical in the Hawaiian Islands. The writer has collected both large and small individuals of *C. isabella* together on several occasions on Oahu. In one instance a large individual, "*controversa,*" was taken copulating with a small individual, *isabella* ss., at Mokapu Point, Oahu. In the Prodome (1939, op. cit., p. 176) the Schilders prefer to call the small Hawaiian individual variant of *C. isabella* Linnaeus by the name *Luria isabella antriceps* nov., as listed by Bryan (1915, Natural History of Hawaii). In the Prodrome (1939, op. cit., p. 176) the large Hawaiian individual variant of *Cypraea isabella* Linnaeus is considered to be a separate species from the small individual variant, and is called *Luria controversa controversa* Gray. The writer has several good series of *Cypraea isabella* Linneaus from Honolulu Harbor, Oahu, Midway Island, and Pearl and Hermes Reef, Hawaiian Islands which show definitely that the Schilders' above two species intergrade one into the other, and are merely size variants. Thus *Luria controversa controversa* Gray and *Luria isabella atriceps* Schilder and Schilder should both be called *Cypraea isabella* Linnaeus instead of being considered as separate species.

Schilder and Schilder (1939, op. cit., p. 172) state concerning *Cypraea gaskoini* Reeve (*C. peasei* Sowerby is a synonym), "We think that *gaskoini* and *peasei* are ecological varieties of one single species (their relation seems to correspond to that of *Staphylaea semiplota* and *polita*) : *peasei* is larger than *gaskoini*, more solid though pellucid, with the outer lip more declivous in front and externally bordered by a callous carina, which projects from the basal level in the anterior third; . . . (size . . , type of *gaskoini* 23 mm., mean of *peasei* 24 mm.)." The reference to *peasei* and *gaskoini* as ecological varieties is without foundation, the differences in the shells are merely individual variations which one encounters in surveying large series from one locality.

Schilder (1933, op. cit., p. 15) identifies the common *Cypraea caputserpentis* Linnaeus of the Hawaiian Islands as *Cypraea caputanguis* Philippi. In the Prodrome the Schilders (1939, op. cit., p. 136) list a *caputserpentis caputanguis* Philippi as being from "S.E. Australia: Botany Bay to Queensland, Lord

Howe I., Norfolk I." and place it on the genus *Erosaria*. In the Prodrome the Schilders (1939, op. cit., p. 136) call the Hawaiian Island *Cypraea caputserpentis* Linnaeus "*Erosaria caputserpentis caputophidii* Schilder."

Schilder and Schilder (1939, op. cit., p. 188, p. 220) list a *Cypraea ventriculus* Lamarck as being found from the Hawaiian Islands from Hawaii to Kauai. They state that it is moderately rare. There are no authentic collections of this cowry from Hawaii yet reported.

In the introduction to the Prodrome of the Schilders (1939, op. cit., p. 120) they state, "Our Prodrome chiefly consists in a catalogue of the living species of Cypraeidae, arranged in a system that we think natural, and divided into geographical races." How could this system be a natural one, with the Schilders shuffling and reshuffling species throughout their long series of publications? With data based on personal examinations of so few specimens and species from certain areas, how can such data be accepted as reliable? Such juggling of the taxonomy of a group is certainly no aid to a natural systematist; it soon kills the amateur's interest, and creates an unnecessary problem for the professional zoologist with yearly changes in the names of shells; especially even when the authorities can not make up their minds, and are continually changing their own identifications. How can one decide what are and what are not geographical races when field collecting has not been done, and when races are established on beach shells?

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TWO NEW SPECIES OF DRYMAEUS FROM MEXICO

By HARALD A. REHDER[1]

Miss Marie Bourgeois recently sent a number of lots of *Drymaeus* from various localities in Mexico to the U. S. National Museum for determination, and among them were two new species which are here described. Great credit is due to Miss Bourgeois for her unflagging energy and zeal in exploring the rich malacological fauna of Mexico.

Drymaeus bourgeoisae, new species. Plate 6, Figure 10.

Shell of medium size, elongately ovate-conic, rather solid, consisting of from 6 to 6½ convex whorls, separated by a well-impressed suture. The nucleus of 1¾ whorls has the typical drymaeid sculpture, while the following whorls are sculptured by low, irregular growth wrinkles, crossed by spiral wavy microscopic grooves. The ground color is white (rendered yellow in fresh specimens by the periostracum) upon which are painted broad spiral chestnut bands, of which there are three on the penultimate whorl and five on the last. These bands are interrupted at intervals by irregular white streaks marking the resting stages in the growth of the shell; on the apertural side of these colorless streaks the spiral bands are axially fused, giving the color pattern the appearance of consisting in places of wavy axial streaks. In the early whorls the spiral bands are much reduced. The aperture is narrowly ovate, the outer lip thin, simple; the columellar margin reflected over a narrow umbilicus.

Height: 23.7 mm.; diameter, 11.4 mm.; height of aperture, 11.2 mm.

The type, U.S.N.M. No. 517550, was collected by Miss Marie Bourgeois near Paraje Nuevo, near Córdoba, Vera Cruz, Mexico, on a mulato tree (*Elaphrium simaruba* (L.) Rose).

Two other specimens, U.S.N.M. No. 517551, were collected by Dr. Martin del Camp, near Orizaba, Vera Cruz.

This species probably belongs in the group of *Drymaeus emeus* Say, having, however, a narrower shell, shorter body whorl, and slightly more convex whorls. In color pattern it is like *Drymaeus attenuatus varicosus* Pfeiffer from Costa Rica, differing markedly from it, however, in the shape of the last whorl and aper-

[1] Published by permission of the Secretary of the Smithsonian Institution.

ture. The coloration likewise resembles that of *Drymaeus droueti* Pfeiffer, which is, however, a shorter wider shell.

DRYMAEUS PERDUCTORUM, new species. Plate 6, Figures 6, 7, 8, 9.

Shell of medium size, elongately ovate-conic, rather thin, consisting of 6 whorls, of which 1½ are the nuclear ones with the typical drymaeid sculpture. The following whorls show only irregular growth wrinkles crossed by microscopic spiral grooves, which in the first postnuclear whorl are fairly distinct, in the later whorls, however, become more or less obscure. The whitish ground color is crossed by slender, tawny-olive to cinnamon brown (Ridgway Color Nomenclature) axial streaks, irregularly spaced and interrupted by a rather narrow band-like gap about halfway between the suture and the periphery; these streaks are of varying strength and may become broad chestnut-colored streaks. Outer lip thin, inner lip strongly reflexed over the narrow umbilicus.

The type, U.S.N.M. No. 517552, measures: Height, 20.2 mm.; diameter, 9.3 mm.; height of aperture, 9.0 mm. Another specimen measures: Height, 25.2 mm.; diameter, 11.5 mm.; height of aperture, 10.7 mm.

The type and five other specimens were collected by guides near Las Grutas de Cacahuamilpa, Guerrero.

This species is near *Drymaeus hegewischi* Pfeiffer, differing, however, markedly in the color pattern. The variation in the color pattern is shown in figures 6–9, figure 6, depicting the holotype.

NOTES AND NEWS

DATES OF THE NAUTILUS.—Volume 56, no. 1, pp. 1–36, pls. 1–4, was mailed July 23, 1942. No. 2, pp. 37–72 + i–vii (title page and indexes of vol. 55), pls. 5–6, Oct. 14, 1942. No. 3, pp. 73–108, pls. 7–11, Feb. 15, 1943. No. 4, pp. 109–144 + i–vii, pls. 12–15, April 19, 1943.—H. B. B.

SOUTHERN RECORD FOR *Aporrhais occidentalis mainensis* JOHNSON.—Last Summer while I was in Barnstable, Mass., a fisherman friend of mine gave me a specimen of this shell which he had found alive in one of his lobster traps, in deep water off

Barnstable light. In Johnson's list of New England mollusks "off Duxbury" is the farthest south reported for it.—Margaret C. Stewart.

The Paleontological Research Institution, Ithaca, N. Y., has recently received, through the generosity of Mrs. C. S. Bentley of Plattsburg, N. Y., the collection of Recent Mollusca made by her husband, the late Dr. C. S. Bentley, and herself. Though consisting largely of West Coast forms, many genotype species are represented from various regions. All specimens are carefully labelled and catalogued. It is proposed by the Institution to use the collection as a nucleus around which to build a substantial collection of recent mollusks for use in future investigation of our Recent and Tertiary faunas.—G. D. Harris.

Puerto Rican Megalomastoma.—In reply to Dr. Baker's somewhat amusing and facetious note on *Megalomastoma croceum* (Nautilus, vol. 56, pp. 106, 107), I may say that during my three expeditions to Puerto Rico I collected mollusks over most of the territory and also kept ecologic notes thereon. My statements on the species of the subgenus *Neopupina* were based on large collections which led me to believe that the species recognized by previous authors had a cause for their existence, since my collecting indicated that they represented different faunal areas in the island and did not appear to transgress on their neighbor's territory. I somewhat regret that I did not give the full list of specimens in our collection, which would probably have given pause to Dr. Baker in making the remarks which he did. I am still convinced that the species which I recognized and which were described by the older authors have cause for existence, Dr. Baker's remarks notwithstanding.—Paul Bartsch.

Cerithidea hegewischii (Philippi), a Pacific Coast Shell. —*Cerithium hegewischii* Philippi (1848) was described merely from Mexico, where it was collected by Hegewisch. There has been some difference of opinion as to whether it came from the Atlantic or Pacific coast. In the Nautilus for July 1942 (vol. 56, p. 24) I sided with Tryon and von Martens in regarding it as a *Cerithidea* of the Pacific. I have recently come across an additional bit of evidence which seems to support this view. Of the three localities cited by Philippi in 1846 with the original

description of *Littorina aspera* (Proc. Zool. Soc. London for 1845, p. 139) one is "from Mexico, found by Hegewisch." As this *L. aspera* is a characteristic snail of the Pacific coast of Mexico, Hegewisch did at least some, if not all, of his collecting there. —J. C. Bequaert.

Tanychlamys versus Macrochlamys.—Question has been raised in regard to my use (1928, 1941) of *Tanychlamys* Benson (1934) and Tanychlamydinae in preference to *Macrochlamys* "Benson" Gray (1847) and Macrochlamydinae. In 1832, Jour. Asia. Soc. Bengal 1: 13, 76, Benson publishes the binomial, *Macrochlamys indica*, without a word of description or definition (Art. 25, Internat. Rules Zool. Nomenclature) or any indication (Opinion 1), which leaves it completely nude. In 1834, Proc. Zool. Soc. London: 89, Benson uses *Tanychlamys* for an unnamed but described species. Thus, *Tanychlamys* is 13 years prior to what is apparently the first valid use of *Macrochlamys*, that of Gray (1847, Proc. Zool. Soc. London: 169). Since, according to Opinion 46, "the first species published in connection with the genus becomes *ipso facto* the type," the type of *Tanyclamys* is *T. indica* (Godwin-Austen) H. B. B. (1941, Bull. Bishop Museum 166: 211). A hearty welcome awaits any suggestions which might obviate legitimately this unfortunate change in a well-known name.—H. B. Baker.

A supplementary note on the mollusks of New York, by Mr. Arthur Jacot (Naut. XXXVI: 2, p. 59–61), which came to my notice after my article had appeared in print (Naut. 56: 4, p. 139–144), requires that certain changes be made in my list. The following species should appear in the second part of my article (*Species appearing on both lists*) instead of the first part (*Species not listed by Mr. Jacot*): *Noetia ponderosa* Say, *Laevicardium mortoni* Conrad, *Donax fossor* Say and *Epitonium humphreysii* Kiener. And the species listed below should be added to the third part (*Species appearing only on Mr. Jacot's list*): *Macoma tenta* Say, *Mesodesma arctatum* Conrad (which I found extensively at Hither Hills State Park near Montauk Point), and *Polinices immaculata* Totten. As for *Haminea solitaria* Say, I found many specimens in Pelham Bay on Hunters Island.

Mr. Jacot also lists *Alectrion fretensis* Perkins and "*Petricola*

dactylus Sowerby'' Gould and Binney: *Invert. of Mass.*, p. 92), neither of which species appears in C. W. Johnson's *List of Marine Molluscs, etc.* Jacot's *Donax variabilis* Say is definitely out of range and should be referred to *D. fossor,* as noted by C. W. Johnson, NAUTILUS 43: 28.—MORRIS K. JACOBSON.

DIADORA JAUMEI Aguayo & Rehder, was described in 1936 from specimens collected near Cuba and from 20 fms. off Miami, Florida. Apparently there has been no further appearance of this shell until August, 1941, when Thomas L. McGinty collected several specimens at Ft. Jefferson, Dry Tortugas, Florida. These latter shells differ in proportion from the holotype (which is stated to measure length 15.4 mm., diam. 10 mm., alt. 9.5 mm.), in being much more depressed, the typical specimen measuring, length 15 mm., diam. 9 mm., alt. 4 mm. Our specimens have a slightly grey-green border around the anal callus. In our opinion this Tortugas shell compares more nearly with *Diadora microsticta* Dall, than with *D. listeri* Orb. or *D. alternata* Say, though it is slightly smaller, less clearly spotted and much more depressed than *D. microsticta.*—JEANNE S. SCHWENGEL.

CORRECTIONS AND ECOLOGICAL NOTES ON SOME RECENTLY DESCRIBED FLORIDA MARINE SHELLS.—In a recently published paper on some new Antillean Mollusks (Proc. U. S. Nat. Mus., vol. 83 (no. 3161, Jan. 20, 1943) pp. 187–203), two of the species described therein through some unfortunate mix-up in labels, bear erroneous localities. *Fartulum nebulosum* Rehder (p. 190, op. cit.) should be recorded from Missouri Key, 14 or 15 miles west of Bonefish Key. *Microdochus floridanus* Rehder (p. 193) was found at Missouri Key, and not Bonefish Key.

Dr. B. R. Bales has called my attention to these errors and has also enclosed descriptions of the habitat of some of the mollusks described in the above paper. He has generously allowed me to publish these interesting ecological notes. *Microdochus floridanus* Rehder was found usually in crowded colonies under large flat rocks imbedded in tough, sticky marl together with *Fartulum nebulosum* Rehder, *Caecum cayoscnse* Rehder, *Caecum sculptum* de Folin, *Phenacolepas hamillei* Fischer, and *Callistochiton shuttleworthianus* Pilsbry. This locality on Missouri Key is a rocky point partly above high water, but for the most part covered by

the tides. Most of the shells mentioned above were collected under rocks uncovered at low water. The *Callistochiton* was usually found on clean rocks, though occasionally collected under marl-covered rocks. *Phenacolepas hamillei* Fischer lives farther inshore, under rocks that are submerged but a short time during high tide. *Asthenothaerus balesi* Rehder was taken from another part of Missouri Key, having been screened out from sandy marl containing many small stones, and sparsely populated with eelgrass.

The place on Bonefish Key, on the other hand, where *Rissoella caribaea* Rehder was collected, is an artificial fill of rocks in clean water, free from marl. Here the little *Rissoella* lives in sparsely populated colonies on the clean rocks, actively moving about, its white tentacles contrasting strongly with the black body, which is visible through the almost transparent shell.—HARALD A. REHDER.

ENSIS MINOR MEGISTUS N. SUBSP., A WEST FLORIDA RAZOR CLAM.—In the course of dredging off Destin, Okaloosa Co., west Florida, one of us (T. L. M.) came upon razor clams in about 20 fathoms, marl bottom, from about 18 to about 20 miles off shore.

The dredge did not dig deep enough to obtain any living shells entire; it cut them off neatly leaving the lower halves in their burrows. However, odd dead valves were quite common, two being shown in plate 6, figs 12, 13. While they are as long as the ordinary *Ensis directus* (Conr.), they are far narrower, the proportions being about as in *Ensis minor* Dall [1] of which one from Galveston, Texas, is figured for comparison (fig. 11).

This large form here figured from off Destin measured 145.5 mm. long, 17 mm. wide. The greatest width is contained more than 8 times in the length—in three measured, 8.27, 8.56 and 8.7 times in the length. The valves are very thin, with fleshy brown concentric streaks on the posterior ray as in *E. minor*. As *Ensis minor* seems to run rather uniform in size, in lots seen, it may be well to have a name for this large race of deeper water, and we are calling it ENSIS MINOR MEGISTUS, the type being 179277 ANSP., paratypes in McGinty collection.

[1] *Ensis minor* was named but not described by Dall, Proc. U. S. Nat. Mus. 22: 108, 1899; the range was given but not the type locality. A good description and figure may be found under that name in Dr. Perry's Marine Shells of the Southwest Coast of Florida, p. 81. 1940.

Two bleached and broken valves of this race were found by Mr. Clarence B. Moore in 1902, on the gulf beach at St. Andrews Sound, Bay Co., a place about 60 or 70 miles east of Destin. They had been labelled *E. directus* in the collection.

Ensis minor, besides being known from our Atlantic coast, occurs on the Gulf coast of Florida at Cedar Keys, Clearwater Harbor, Tampa Bay, etc., as well as in Galveston Bay, Texas, but the largest seen from these places is 75 mm. long, 9.6 mm. wide; another large one 68 × 9.6 mm. It is a shell of sandy bars and shallow water.

We do not know that *Ensis directus* has been reported from any Gulf locality, but there is one valve in the Academy collection received with shells from Boca Grande, Gasparilla Bay, collected by the late T. Charlton Henry in 1926.—H. A. Pilsbry & T. L. McGinty.

Note on Cerion striatellum ("Fér." Guérin).—In the literature of *Cerion* this name has been applied by Poey and some later authors to a Cuban (Cabo Cruz) species, and by others to a Puerto Rican shell. In Manual of Conchology, 14: 278, I adopted the former identification, referring the Puerto Rican shell to *C. crassilabris* ("Shuttl." Sowerby). In going over cerions which have been "planted" on the Florida Keys I had occasion to review the matter, and concluded that the Cabo Cruz species is not *striatellum.* After getting this result independently, I found a note under the trays in the collection to the effect that Dr. de la Torre and I reached this same conclusion many years ago, when going over our series. The Cabo Cruz species may be called *C.* cabocruzense Pilsbry & Torre. The description of "*striatellum*" in Man. Conch. 14: 278 defines *cabocruzense,* pl. 46, fig. 21, representing the type. Figs. 20. 22, 23 are other topotypic specimens. It may prove to be connected with *C. basistriatum* Pils. & Van., a smooth form from the same locality. *Cerion longidens* Pils., Man. Conch. 14: 212, is a larger and stouter shell, with slightly different parietal armature; but thorough collections from the Cabo Cruz region are needed to elucidate the relations existing between the allied forms, *basistriatum, cabocruzense* and *longidens.*

Cerion striatellum (Guérin) is believed to be the Puerto Rican species commonly known as *C. crassilabris* ("*Pupa crassi-*

labris Shuttleworth" of Sowerby, Conch. Icon. 1875, not *Pupa crassilabris* Parreyss in Pfeiffer, Mon. Hel. Viv. 2: 134, 1848). The collection name attributed to Shuttleworth was never published by him, and in any case could not be used. *C. striatellum* is slightly larger than any *cabocruzense* seen, the type figure being 25 mm. long. Other differences as given in Man. Conch. 14: 192. The name *Pupa striatella* was attributed to Férussac, but was first published in Guérin-Méneville's illustrated *Règne Animal* of Cuvier (Moll. p. 16, pl. 6, fig. 12). This work appeared at intervals, plate 6 in 1829 or shortly after. Griffith & Pidgeon copied the figure (rather badly) in their English edition of 1834. It was this species which Dr. Bartsch planted in 1915 on Loggerhead Key and Garden Key, Tortugas, where it still flourishes.—Pilsbry.

Jeanne S. Schwengel was awarded the honorary degree of Sc.D. by the University of Dayton, on April 18, in recognition of her work on mollusks.

Western Shell Collections.—The Minutes of the Conchological Club of Southern California, No. 24, for June, contains records of the principal collections of the West Coast, especially those containing type material.

Richard A. McLean, assistant curator of mollusks at the Academy of Natural Sciences of Philadelphia, has been commissioned an ensign in the Navy and is now stationed at Cape May, N. J.

International Directory of Malacologists (including shell collectors). By Maxwell Smith, Lantana, Florida. Third Edition, 1943, 50 pp., price $1.75. Chiefly confined to American conchologists, but some from Australia, Mauritius and New Zealand are included. It is illustrated with many figures of characteristic shells from each State and Country.

MRS. W. H. ESHNAUR
1862–1943

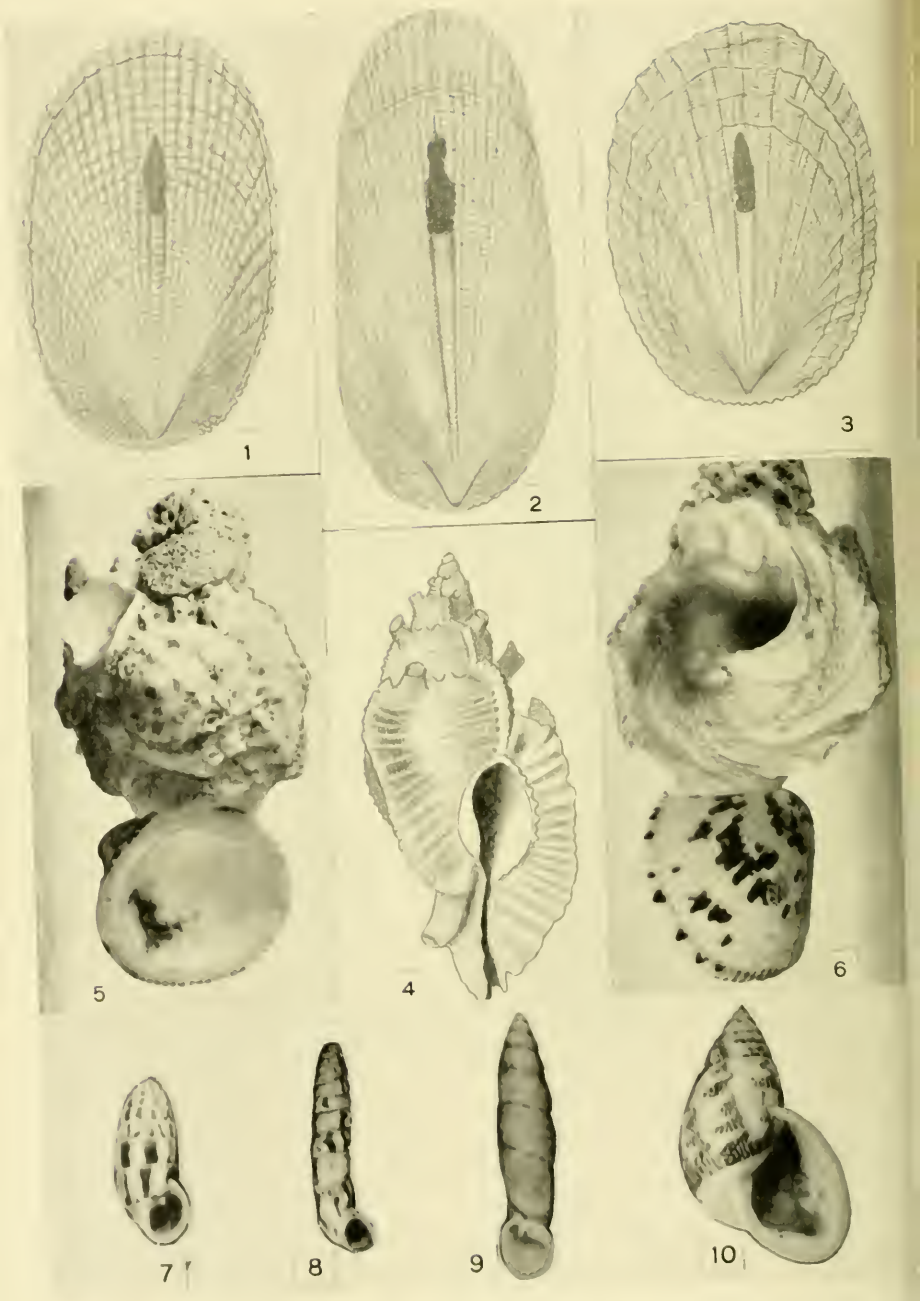
There will be widespread regret at the news of the death of Mrs. W. H. Eshnaur, which occurred at Bellflower, Calif. on April 13th, 1943. Mrs. Eshnaur was the last of the group of conchologists who formed the original Conchological Club of

Southern California and carried on for many years in a way which laid foundations for much of the work done later.

Nannie Milton Mock was born near Rockport, Indiana, on April 17th, 1862, but was living in Missouri at the time of her marriage to Warren H. Eshnaur which took place at Kansas City, Mo., in 1884. She and Mr. Eshnaur were already interested in shells before they moved to California in 1898, and after they settled at Terminal Island in 1903 they were able to spend a great deal of time and enthusiastic effort on collecting grounds that have been completely destroyed by the development of Los Angeles Harbor. Mrs. Eshnaur was not a charter member of the Conchological Club of Southern California but joined at a very early date. Because of the poor health which was a life-long handicap she was inactive for several years but was always interested and very kind in advising younger collectors in the best methods and localities for collecting the local shells.

In 1919 Mr. and Mrs. Eshnaur moved to Bellflower and shortly thereafter Mrs. Eshnaur revived her club membership and as the club was no longer exclusively feminine Mr. Eshnaur joined the club roll. After Mr. Eshnaur's retirement from active railroading the Eshnaurs made several long trips and added a great deal to their already large collection. But Mr. Eshnaur passed away in 1935 and since that time Mrs. Eshnaur, realizing that none of her family were particularly interested in shells, had given invaluable material including the type of *Periploma sulcata* Dall, to the U. S. N. M., had sold her main collection and arranged for the distribution of many duplicates to a new generation of collectors.

Mrs. Eshnaur is survived by one son, three grandchildren, and five great-grandchildren, but the group of friends and correspondents who will miss her is spread over much of the world.—E. M. Chace.



1, Rimula frenulata. 2, Rimula longa. 3, Rimula pycnonema. 4, Typhis fordi. 5, 6, Xenophora robusta. 7, Cerion deani. 8, Cerion pauli. 9, Xenia juninensis. 10, Drymaeus inca.

THE NAUTILUS

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ANOTHER SPECIMEN OF XENOPHORA ROBUSTA

By M. E. BOURGEOIS

In one of the papers that I received in 1941 from the California Academy of Sciences, there is a description of the shell *Xenophora robusta* Verrill, in which it is said that before the Templeton Crocker Expedition in 1932, which dredged eight specimens, 6 living and 2 dead, this shell was known only from the description of the two original specimens taken near La Paz by J. Pedersen in March, 1870.

Imagine my surprise on reading this, when I realized that I had in my collection a perfect specimen of this species, found by me on Playa Larga ("Long Beach"), Acapulco, December, 1930. Before this, I had not appreciated that it was such a rare specimen, and which from the account of the California Academy of Sciences, proves to be the third specimen found, and the only other specimen known, apart from those dredged by the Templeton Crocker Expedition.

My specimen (Plate 7, figs. 5, 6) is a very fresh shell and perfect in detail, as to apex, base and apertural margin. The aperture itself is very bright and shiny, as if the animal had just been removed.

The two views of the shell, kindly taken by Prof. Ancona H. of the Biological Institute of Mexico City, are excellent; beautifully showing the details of the base of the shell and the one perfect erratic, a *Glycymeris*, still fastened to the shell, besides pebbles and a fragment of another erratic. The figures are smaller than natural size.

FLORIDIAN SPECIES OF RIMULA

By H. A. PILSBRY

Five species of *Rimula* are now known from Florida. All are rare shells. Two of them, *R. larva* Dall and *R. acquisculpta* Dall,

have not been figured, and some structural points remain obscure. Thus *R. larva* was described as "long-ovate," but by the dimensions given it should be the most shortly ovate of our species, the width nearly three-fourths of the length. The highest species is *R. acquisculpta*, the height half of the length. In others the height is 40 per cent of the length or less. The new species were generously given by Mrs. Jeanne S. Schwengel.

The following key contrasting the species has been composed. The size will of course vary with age, but the proportions are probably rather stable.

1. Width of shell less than half of its length. Sculpture of radial riblets and equally spaced concentric threads. Length 6.5 width 3, height 1.8 mm. Off Destin, Fla.....*R. longa*, n. sp.
   Width decidedly more than half of the length.....2
2. Apex at posterior fourth of length; height half the length. Sculpture of 40 equal ribs and close concentric threads. Length 5, width 3, height 2.5 mm. Ajax Reef, Fla.
   R. acquisculpta Dall
   Apex nearer the posterior end; height less than half the length.....3
3. Sculpture of fine, granulate radiating lines, with lines of granules in interspaces; margin entire; slit half as long as the shell. Length 3, width 2.3, height 1 mm. Off Fernandina, Fla.....*R. larva* Dall.
   Sculpture of radial threads or riblets and concentric threads; slit shorter; margin crenulate.....4
4. Concentric threads fine and very close, much lower than the radial riblets; width about 68 per cent of length, length 3.7, width 2.5, height 1.5 mm. Off Palm Beach
   R. pycnonema, n. sp.
   Concentric threads spaced about like radials and nearly as high; width 60–64 per cent of length. Length 6.25, width 3.75, height 2.3 mm. to l. 5.8, w. 3.7, h. 2 mm. Florida and Keys
   R. frenulata Dall

References:—*R. frenulata*, "Blake" Gastropoda, p. 406, pl. 28 fig. 4. *R. larva*, Proc. U. S. Nat. Mus. 70, art. 18; 113. *R. acquisculpta*, same Proc., art. 19: 9.

Rimula longa, n. sp. Plate 7, fig. 2.

The white shell is oblong, rather narrow, the width slightly less than half the length, with subparallel sides; low, the height contained about 3.6 times in the length. Apex small, laterally

compressed, nearly terminal above the posterior end, the minute glossy nucleus of about one whorl visible on the right side but not projecting. Posterior slope very short and concave, anterior slope convexly arched. Slit-fasciole shallow, continuous from fissure to apex, as wide as the slit and marked with semilunar incremental lines. Sculpture of evenly spaced narrow radiating riblets from apex to margin, crossed by concentric threads, weak over the ribs, and dividing the intercostal intervals into squares. The radial riblets are a little stronger over the anterior half and near the posterior margin than at the sides. Interior glossy, with two faint ridges extending from slit to apex, continued from the callus bounding the fissure. The margin shows slight crenulations from outer sculpture. Length 6.5 mm., breadth 3 mm., height 1.8 mm., length of slit 1.5 mm.

Dredged in 13 fathoms off Destin, northwest Florida, by T. L. McGinty. Type A.N.S.P. 178632, others in the McGinty collection.

This is the narrowest and relatively lowest of our species, with sculpture similar to *R. frenulata*, which appears nearly related, but is higher and wider.

Rimula pycnonema, n. sp. Plate 7, fig. 3.

The white shell is oval, the width about 68 per cent of the length, height about 40 per cent of the length. Apex elevated, recurved nearly to the posterior margin. Anterior slope convex, posterior slope short and, except near the apex, straight. Sculpture of about 34 subequal narrow radiating riblets, spreading gracefully from apex to margin, their intervals divided by quite small interstitial radii; crossed by fine, close, wavy concentric threads, in places near the margin becoming almost lamellar, far lower than the primary radial riblets, and somewhat interrupted by the inconspicuous secondary radials. Margin crenulated, slit about one fifth the length of shell, its posterior end at the middle of the length of shell. Interior smooth, showing a slight callus around the slit. Length 3.7 mm., breadth 2.5 mm., height 1.5 mm.

Dredged off Palm Beach, Florida; in about 250 to 300 feet, by Thomas L. McGinty. Type A.N.S.P. 178633; also in McGinty collection.

This species is probably somewhat similar to the unfigured *R. aequisculpta* Dall, but is lower and slightly narrower relatively, and the apex is nearer to the posterior end. The concentric threads are much slighter and closer than in *longa* or *frenulata*.

Rimula frenulata Dall. Plate 7, fig. 1.

In this species the apex may project a little beyond the posterior outline, as in Dall's figure, and specimens from off Palm Beach in 65–70 fms., or it may fall short of the posterior end, as in those from Bonefish Key in shallow water, one of which is drawn in Plate 7, fig. 1.

TYPHIS FORDI, A NEW BAHAMAN MURICID MOLLUSK

By H. A. PILSBRY

Among Bahaman mollusks received from the Rev. Paul D. Ford, President of the Bahamas Conchological Society, were examples of a handsome *Typhis*, quite unlike any Antillean member of the genus, recent or fossil, known to me.

Typhis fordi, new species. Plate 7, fig. 4.

The shell is rather small and slender, the diameter less than half of the length; cartridge buff; of about six whorls parted by a rather deep suture, which is irregular by the presence of small denticles rising from its anterior margin, about two or three between each varix and the following tube. Embryonic shell wanting in specimens seen, the first two whorls preserved being plain, following whorls having narrow, straight varices, becoming prominent on the last whorl, where they are flat, broader in the anterior part, conspicuously fluted on both sides, there being about 15 corrugations on the last varix. Spaces between varices having spiral cords. Tubes are moderately long, bending upward and backward a little, and arising a short distance behind each varix, with which the base of the tube is connected by a low ridge. Aperture oval, with a narrow rim upon the varix; the rather long anterior canal is quite narrowly open in front. Length 17.4 mm., Type and paratype 179712 ANSP., from 5 miles west of Nassau, on the north coast of New Providence.

This species belongs to the subgenus *Pterotyphis* Jousseaume, which is characteristic of west Mexican shores. It is nearly related to *T. pinnatus* Broderip, the type of that group, and is interesting as representing another Pacific (Panamic) group in the West Indies.

COLLECTING SHELLS IN THE SOLOMON ISLANDS

By WALTER J. EYERDAM

Now that the Solomons are in the news every day and we are all vitally interested in what is going on down there, a few notes on my shell collecting activities on these islands, when I was collecting birds as a member of the Whitney South Sea Expedition in 1929–30, may be of interest.

When I saw in the newspapers the pictures of the landing made by the first contingent of marines on Quadalcanal Island, I recognized right away the beach near Berandi, where our expedition stopped for a day at the plantation of Mr. Robertson, to pick up Gordon White, the assistant of Dr. S. M. Lambert, chief of the Rockefeller Foundation anti-disease campaign in the South Seas. We were bound for Rennell Island, a hitherto unexplored and unspoiled paradise or "Lost world" of healthy and beautiful savages.

The long cobblestone beach at Berandi looked very unpromising for shells, since the heavy winds rolled the breakers high and washed the round stones to and fro. On sandy stretches, I had better luck and collected 54 species of marines in about an hour, including a dozen that were new to me. Some of the species of cones had remarkably heavy shells, as a protection that nature had given against buffeting on the stony beach.

Jack London wrote "The Cruise of the Snark," which told much about the Solomons, especially in places I have since visited and collected biological material. Martin Johnson accompanied him on the Snark. I did not know that London had written another very interesting book about Guadalcanal, until I found "Die Insel Berandi" in an old bookstore in Saarbrücken in 1931, and read it eagerly. A few days afterwards, I spent three days as the guest of Dr. Eugene Paravicini, director of the Museum of Ethnography, in Basle, Switzerland, and had time to see most of his immense collection of ethnographic and anthopologic material, which he collected in the Solomons.

It seems that London's book "The Island of Berandi" was founded on fact. The heroine, an adventurous young American girl was shipwrecked on Guadalcanal in her father's yacht. With her American fiancé and a faithful attendant, a fine big Polynesian

whom the natives called "one fellow Adam-Adam" and who had saved the lives of the two Americans, a plantation was started at Berandi. The fiancé died of fever and the girl married the Polynesian. Wild and tough Malaita bushmen were imported as indentured laborers and disciplined with the aid of lash and gun. Jack London got his story directly from the shipwrecked American woman.

In 1928, when Dr. Paravicini stopped at that plantation, he met a good-looking young woman, armed with a gun and a heavy whip, bossing a gang of Malaita men. She invited him to dinner, and soon appeared dressed as a lady in up-to-date European style. She managed the place alone and handled the crew of tough Malaita men, who worked well for her. This girl seems to have been the daughter of London's heroine, who with the Polynesian father had died some years before and left her to manage the estate.

Dr. Paravicini found 2 new subspecies of *Papuina* and 3 new species and 5 new subspecies of *Placostylus* in the Solomons; these were described by Dr. Rensch. I found 2 new species and 2 new subspecies of *Papuina* and 4 new species and 1 subspecies of *Placostylus*, which were described by Wm. J. Clench.

After the war, if conditions permit, a great deal of work in the line of biological explorations in the Solomons awaits accomplishment. The birds and the butterflies have been quite well studied, but the botany and the land snails of the mountainous interior are still but little known.

ABUNDANCE-AREAS OF *MESODON PENNSYLVANICUS* (GREEN)

By GLENN R. WEBB

During approximately six years of casual collecting in eastern Marion County (Warren Township), Indiana, it has become evident that the land snail *Mesodon pennsylvanicus* (Green) exhibits extreme variations in abundance in this area—it being rare [1] in most localities but abundant at a few. It is the purpose of this

[1] One finds less than one *pennsylvanicus* to 25 specimens of other Polygyrids, hence, an estimated abundance-ratio of 1/25.

paper to commence a catalogue of the previously reported abundance-areas [2] of the species, to describe two seemingly new areas, and to cite information of possible use in the location of other such elsewhere.

Among the limited number of reports of areas where *pennsylvanicus* occurs in any degree of commonness whatsoever, but two indubitable records of abundance-areas are known to me. One of these is the Ohio record of Call (1900) who wrote: "Around Cincinnati, in favorable localities, it is common, a hundred being collected in one spot a few feet square in a single afternoon." The other is that discovered at some locality near Monroe, Michigan by the late Sister Catherine of the convent near there.[3]

As has been stated, two abundance-areas have been found in eastern Marion County, Indiana. Since these areas are both located near Indianapolis, they lie within the region where the species has been called common by Stein (1881). However, the Stein data does not seem to necessitate reporting these areas as other than new.

One of these areas comprises a segment of the former right-of-way of the Indianapolis & Cincinnati Traction Company between Kitley Avenue and Sears Avenue. The entire segment, however, is not populated by the species, for only in certain parts have the ecologic forces of the region been allowed to run their course and commence reforestation with a stand of saplings. Another of the more obvious factors influencing the ecologic development is the presence of Lick Creek and its tributary, Little Lick Creek, which together meanderingly parallel [4] the segment as one stream.

Three snail-collecting localities have been recognized in this area: (1) Loc. R, situated just southwest of the cite of the Brookville Road underpass of the former electric-railway; (2) Loc. RR, that part of the right-of-way from the underpass at the Indianapolis-Rushville section of the P.C.C. & St. L. Railroad [5] to Broadhead Road; and (3) Loc. RR-1, that portion from Broadhead Road north to the banks of Little Lick Creek.

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[2] Defined as: An area with a much denser population of the species than other parts of the same region.

[3] Phil L. Marsh: Personal communication.

[4] At distances varying from 0 to about 200 feet.

[5] Also known as the Baltimore & Ohio RR.

At each of the foregoing localities *pennsylvanicus* occurs in considerable abundance and far outnumbers *Mesodon thyroidus* (Say), the only other *Mesodon* inhabiting the right-of-way to any extent.[6] A preliminary population-count June 28, 1941 and Loc. RR-1 revealed 16 *pennsylvanicus* specimens in an area of about 78 square feet—a population density of roughly one specimen per five square feet. No *thyroidus* were found in the census plot.

Mention must now be made of the second abundance-area, Loc. 2X. This area is located about the Dietrich-Kline Ditch Bridge on the Indianapolis-Greenfield section of the P.C.C. & St. L. Railroad embankment 1/16 of a mile west of Mitthoefer Road. From the south side of the embankment the population seems to have spread southward into an adjacent woodland—only the northern part being inhabited by the species.

Although it is impossible to offer any explanation as to why *Mesodon pennsylvanicus* should be so abundant in these two areas, it is not amiss to emphasize certain of the more obvious conditions which may be important factors in the problem. These are: (1) the repeated occurence of a graveled road-bed at the localities; (2) the presence of a stream nearby; (3) the repeated occurence of relatively undisturbed wooded areas adjacent to the abundance-areas; and (4) the relative absence of other *Mesodon* species in the populated areas (i.e. the high ratio of the *pennsylvanicus* population to that of any other species of the genus). One possible test of the relationship these conditions may have on the occurence of *pennsylvanicus* abundance-areas would be to attempt to locate other such areas, within the range of the species, at points where these conditions occur.

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[6] A solitary specimen of *M. elevatus* (Say) has been found at Loc. RR-1.

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MARL DEPOSITS IN BONAVENTURE, NORTH OF BAY CHALEUR, QUEBEC, CANADA, AND IN HOULTON, MAINE

BY OLOF O. NYLANDER

Since the opening of the road from St. Leonards across the north of New Brunswick to Bay Chaleur, I have been able to make a trip there nearly every summer; sometimes even two. My chief object has been to check up on the many publications related to the fossils and to collect specimens for my collection, and to take photographs of the most important places.

On October 19th, 1940, we stopped at a place along the road to examine a marl deposit that I had noticed in passing by there several times before. This was on a farm belonging to a Mr. Leazari Henry, in east Bonaventure, north of Bay Chaleur. The day was cold and windy, and our time limited, so I could not spend the time to give the subject all the attention it should have had. The marl deposit is 12 feet thick, (overlaid by two feet of peat) which has been worked for 17 years. The marl is sold to farmers for 50¢ a yard and is used for improving the land. The marl is largely deposited by algae with some remains of fresh water shells. In the top layer of the marl are many large fresh water snails, *Lymnaea stagnalis* L., in a good state of preservation.

Fossaria umbilicata, C. B. Adams, rather scarce.
Helisoma trivolvis Say, 7 specimens.
Gyraulus parvus Say, common.
Sphaerium sulcatum Lam, 1 partly preserved.
Pisidium, 1 large specimen of a species not seen before.

This deposit is remarkable because *L. stagnalis* is abundant in the top layer. To my knowledge it has not been found living in

any body of water in north-eastern America where all the other species are of common occurence.

On August 16, 1933, near the Maine No. 1 highway, on Mr. Edward C. Currier's farm in the northern part of Houlton, I discovered a peat bog of about 4 feet in thickness. It was underlaid by a marl bed about a foot thick, and in this marl deposit is a lot of fresh water shells, all of which are of a large size for their species. *Lymnaea stagnalis* Linné is found in the top of the marl and must have been in abundance, as several specimens were there, all of a good size, but so brittle that only a few good specimens were secured.

The following is a list of the 14 species of shells observed:

Valvata lewisi Currier
Physa heterostropha Say
Lymnaea stagnalis Linné
Fossaria obrussa decampi Streng
Helisoma trivolvis Say
Helisoma anceps Menke
Helisoma companulatum Say
Gyraulus parvus Say
Sphaerium sulcatum Lamarck
Sphaerium rhomboideum Say
Musculum securis Prime
Pisidium variabile Prime
Pisidium ventricosum Prime
Pisidium contortum Prime

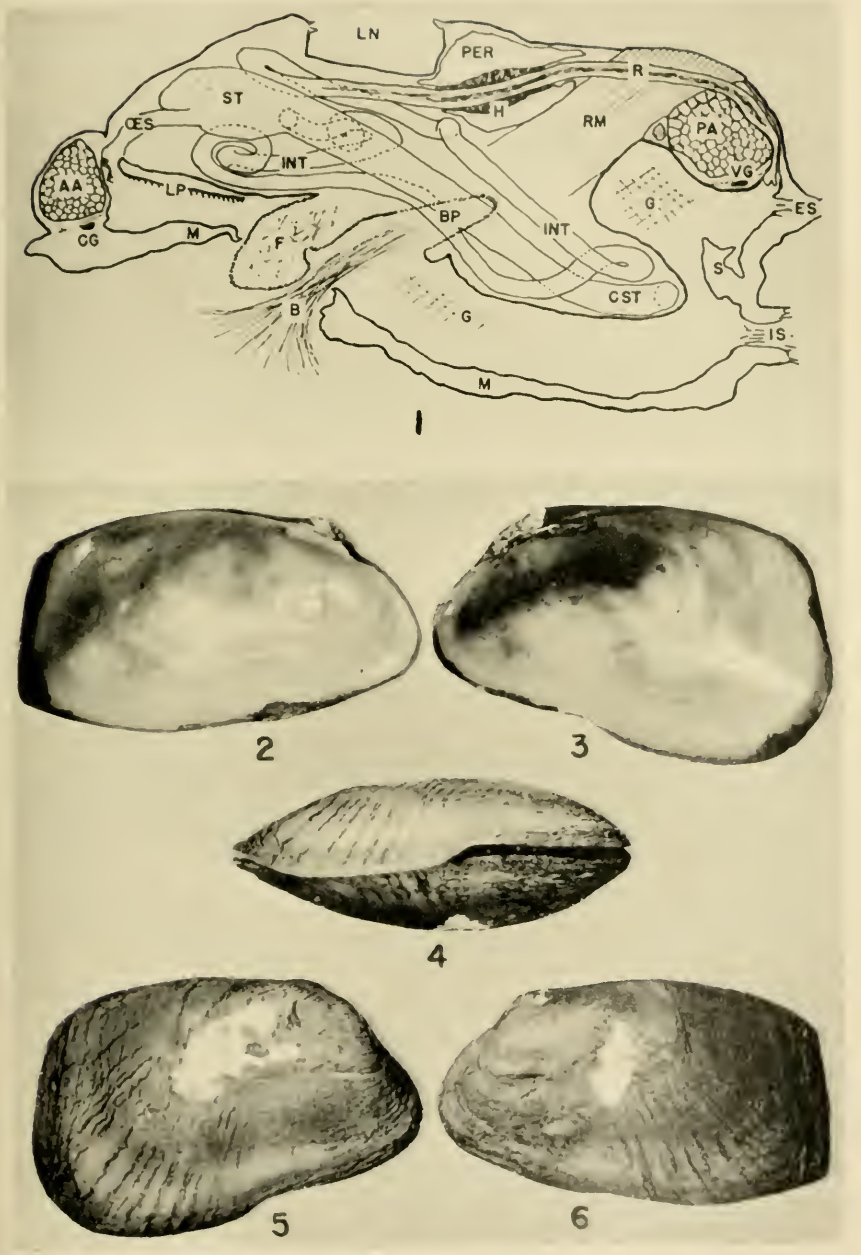
A NEW TYPE OF FRESH WATER CLAM FROM BRITISH GUIANA

By J. P. E. MORRISON[1]

The writer was fortunate enough to be a student during the 1925 summer session at the Kartabo Zoological laboratory of the University of Pittsburgh. Each student's work consisted principally of ecological observations and collections of animals of the group in which he was most interested. My own knowledge of mollusks was considerably broadened and increased by these first-hand studies in Tropical Animal Ecology, made possible largely through the efforts of my professors at the University of Chicago, Dr. W. C. Allee and Dr. H. C. Cowles.

Kartabo Point, widely publicized by Wm. Beebe in his books on the jungle life of British Guiana, proved to be relatively barren of Mollusca. Lying as it does in the second-growth jungle area of formerly extensive plantation clearings in the Guiana lowlands, the environment is much different from that of the

[1] Published by permission of the Secretary of the Smithsonian Institution.



Guianadesma sinuosum.

virgin jungle. The most productive habitat in the thickly matted second-growth forest is under or around fallen logs, where such species as *Euglandina surinamensis* Vernhout, *Leptinaria lamellata concentrica* Reeve, *Euconulus cassiquensis* (Newcomb), *Vitrea decolorata* (Drouet), *Stenopus cayennensis* (Pfr.), and *Succinea recisa* Morelet were found sparingly. In the area near the Cuyuni River, *Helicina* (*Sericea*) *sericea* Morelet was found in the leaf-mold and on trunks of the smaller trees, as far as eight feet above the ground.

Even five miles away, in the more open but more heavily shaded and higher-roofed virgin jungle, relatively fewer molluscan species were found. *Auris distorta sublaevis* Pilsbry, *Corona perversa* (Swainson), and *Orthalicus sultana* Dillwyn were taken from the trunks of certain smooth-barked jungle trees. *Drymaeus cinnamomeolineatus* (Moricand) on the other hand was found on the leaves and branches of some smaller trees near jungle clearings, as high as five feet from the ground. *Aperostoma* (*Cyclohidalgoa*) *translucida major* H. B. Baker and a slug, *Vaginulus* sp., were found here on the virgin jungle floor. Although intensive enough search was not made to disprove their presence, no smaller species of mollusks were evident on the jungle floor. In the Kartabo area it is never hotter than 89° F. in the shade of the jungle, but it might be that temperature every day in the year, coupled with almost 100 per cent humidity. The jungle environment here seems too monotonous to serve as much of a stimulus for the production or survival of a multitude of different species.

Some of the very few species of mollusks actually present at Kartabo have been introduced by man's agency since the Dutch first settled on Kyk-over-al Island, opposite Kartabo in the Mazaruni River, in the year 1626. It is probable, but not certainly known that the Spanish were there earlier. This island in midstream at the junction of the Cuyuni and Mazaruni Rivers, also commands the junction of the Mazaruni and the Essequibo, in sight just four miles downstream. A garrison here controlled the entire Essequibo district by controlling travel in the Essequibo basin. Even now such control is possible because all travel to and from the Mazaruni and Cuyuni diamond and gold fields is still by means of river boats. Among the smaller species of land

mollusks that were found mostly on Kyk-over-al Island, and that in all probability have been accidentally introduced by man sometime in the past 300 years are *Opeas goodalli* (Miller), *Subulina octona* (Brug.), *Streptaxis glaber* (Pfr.), and *Luntia insignis* Smith. *Bothriopupa tenuidens* (C. B. Ads.), found only in the leafmold in the dry season, but dotting the under side of shrubbery leaves four feet off the ground during the wet season, was probably brought in from some other place in the Americas, as was the little helicinid, *Poenia lirata* (Pfr.).

The waters at Kartabo are transitional in character; 45 miles inland from the seven mile wide mouth of the Essequibo, the water is practically fresh, although tidal influence reaches beyond. The fall line, at the first rapids, is about 5 miles upstream in both the Mazaruni and the Cuyuni Rivers. There is about six feet of tide at Kartabo; in fresh waters this is not conducive to the survival of many molluscan species in the region.

All four species of mollusks of the ordinary freshwater types found here were restricted to waters out of the reach of the tide or were better developed in such situations. For example: there is a species of pill-clam (*Pisidium*) in the intermittent rain pools of the virgin jungle; one freshwater mussel, *Diplodon granosus* (Brug.), was found just 100 yards above the influence of the tide in a small tributary of the Cuyuni River at the fall line; the large apple snails (*Pomacea*), and the Black river snails, *Doryssa consolidata* (Brug.) are found at and above the fall line in abundance. Occasionally their shells are washed down as far as Kartabo in the drift, but only the *Doryssa* has been found living in the river near Kartabo, surviving there in small numbers in the reaches of tidal freshwater.

There are only two species of freshwater mollusks that belong to the transitional zone of the Cuyuni River, a small brackish water type of snail (*Littoridina*), and a very distinct type of byssiferous clam. This little clam, previously unnamed, has been more or less of a puzzle since it was first collected by Dr. Wesley Newcomb almost a century ago. Now determination of its gross anatomy by reconstruction from camera lucida drawings of serial longitudinal sections of the entire animal has made possible its correct taxonomic placement.

Family LYONSIIDAE (Thiele, 3: 936: 1934).

GUIANADESMA, new genus.

Shell small, slightly inequivalve, rhomboidal, translucent, nacreous-porcellanous within, furnished with a variously wrinkled epidermis. Hinge anodont. Ligament short, internal, opisthodetic, that is posterior to the beaks, on a narrow ledge; without an ossicle. Pallial sinus broad, shallow. Right valve emarginate postero-ventrally.

Animal byssiferous, foot small, cylindrical; mantle largely united, with foot and byssal orifice and two short, separate siphons, with a briefly continued internal septum. Inner and outer branchiae subequal, free below from the abdominal sac and from the mantle.

Genotype: *Guianadesma sinuosum*, new species.

This genus differs from all other known members of the family in the complete absence of the lithodesma or shelly structure in the ligament. It might be placed in a separate family if it were not evident that the loss of only one character is of insufficient taxonomic value, this loss having also occurred in certain forms of the related family Pandoridae.

The single species known is estuarine, in practically fresh (tidal) water in the Essequibo drainage in British Guiana. *Guianadesma* is best regarded as a geographically isolated, aberrant member of the Lyonsiidae, which has lost the ligamental ossification, but has maintained the other general characters of the group during its transition to a freshwater habitat. Its most similar living relative seems to be *Agriodesma* Dall, 1909, from the southern California coast.

GUIANADESMA SINUOSUM, new species. Plate 8.

Shell small, long rhomboidal, regularly slightly sinuous and inequivalve, periostracum light straw-colored; nacre within hard, porcellanous, translucent whitish. Ligament short, opisthodetic, internal, without an ossicle, on a narrow ledge behind which is the wide shallow beak cavity; hinge anodont. The light straw-colored epidermis, becoming slightly darker with age, is wrinkled in a characteristic fashion on both valves; the anterior portion is wrinkled irregularly concentrically, to give the appearance of scaled fish skin; the median portion, in front of and over the posterior ridge, is raised into about twelve irregular or doubled radial epidermal folds; above the posterior ridge there is usually a return to a concentric folding; in some specimens both radial and concentric wrinkles are present above the posterior ridge. The

umbones, one-third from the anterior end, eroded even in the smallest specimens seen (4.5 mm. long), are apparently smooth. Adductor muscle scars subequal, the posterior the larger, in front of which are the large posterior retractor scars (in effect the byssal retractor muscle scars); anterior retractor and protractor scars small, inconspicuous. The pallial line is distant from the margin; the pallial sinus is shallow and wide, extending entirely across the posterior end of the shell. The left valve is usually evenly rhomboidal, the dorsal line straight to slightly arched below the umbones to meet the dorsally truncate anterior slope in a widely rounded curve. The anterior end is narrowly rounded at the base. The ventral margin is entire, straight to slightly curved; the posterior end abruptly truncate, the posterior point at the base. Sometimes the left valve is a little cut away post-ventrally, corresponding to the emargination of the right valve. The right valve is irregularly rhomboidal, differing in outline by an irregular ventral margin, which is broadly emarginate behind the middle, in the region of the radial epidermal wrinkles, and is not so abruptly truncate, but a little more evenly rounded behind. The shell is hardly sinuous above, but the post-ventral extension and overlap of the right valve produces a marked sinuosity below.

The type (U.S.N.M. No. 536901) was personally collected July 27, 1925 from rocks in the midstream of the Cuyuni River, opposite Kartabo Point, near its junction with the Mazaruni River, Essequibo District, British Guiana. The type measures: 17.3 mm. R., 17.4 mm. L., long; Height, 11.1 mm. R., 9.8 mm. L.; Diameter, 7.0 mm. There are a number of paratypes in the United States National Museum collections, and in those of the Carnegie Museum (collected by the writer and Joseph Benkert).

The animal is byssiferous, with a small cylindrical foot; the byssiferous gland and pit immediately behind and as large as the foot, extends through the abdominal sac to and connects with the large posterior retractor muscles. The adductor muscles are subequal, the posterior a little larger; the anterior retractor and protractor muscles are small and inconspicuous. The mantle margins are united except for the midventral foot and byssal aperture, and the two short, strong, separate siphons, whose separation is continued internally as a brief horizontal septum. Branchial siphon papillose; the gills are eulamellibranchiate, and free from both the visceral mass and the mantle below. There is no branchial septum. The labial palps are moderate in size, extending backwards almost to the base of the foot. There is a large crystalline style in a sac one-fourth as long as, and larger in

diameter than the intestine, and apparently smooth. The byssus is heavy, short, much branched externally, and has the appearance of being added to only as the animal grows, to anchor in one spot, not as adventitiously applied as in *Mytilus*.

This species was collected in moderate abundance from the igneous rocks that jut out of the Cuyuni River opposite Kartabo Point, and from similar ones two miles upstream in the Cuyuni. They were always found attached to the rocks or to smaller fragments (gravel) by their byssus, and were only present in channels that the river current utilizes through or around the rocks. On those rocks surrounded by mud bars, there were no clams to be found. They were found at or just below the low tide line. In both localities, on the rocks opposite and on those two miles upstream from Kartabo, these little clams were collected with a few specimens of *Doryssa consolidata* (Brug.). This freshwater snail, so abundant at and above the fall line, does not extend farther downstream into tidewater, at least in the Cuyuni or Mazaruni Rivers; its presence here indicates how completely freshwater the habitat of *Guianadesma* really is.

The Isaac Lea Collection contains three specimens (U.S.N.M. No. 86803) collected by Dr. Wesley Newcomb, and incorrectly labelled as *Bartlettia stefanensis* Moricand (from the Amazon River, South America). There may be additional specimens preserved in the Newcomb Collection at Cornell University or in collections of correspondents of Dr. Newcomb other than Isaac Lea. According to Stearns (Nautilus 5: 123) Dr. Newcomb collected in Demerara sometime in 1846–7. During this time he collected *Doryssa consolidata* at the "Falls" (fall line) of the Essequibo River (U.S.N.M. No. 98095–6). It is thus evident that he collected these specimens of *Guianadesma* from the Essequibo. The shells in question are very slightly different in appearance from those personally collected in the Cuyuni nearby, but are not specifically distinct. The individual shells are so variable that it would require large series of specimens from each locality to demonstrate any possible subspecific distinctions of this species as found in the limited tidal freshwater reaches of the Essequibo, Mazaruni, and Cuyuni Rivers.

Explanation of Plate 8

Fig. 1. *Guianadesma sinuosum*, diagram of gross anatomy of a paratype. AA, anterior adductor muscle. B, byssus. BP, byssal pit. CG, cerebral ganglia. CST, crystalline style sac. ES, excurrent siphon. F, foot. G, gill. H, heart. INT, intestine. IS, incurrent siphon. LN, ligamental notch. LP, labial palps. M, mantle. OES, oesophagus. PA, posterior adductor muscle. PER, pericardium. R, rectum. RM, posterior retractor muscle. S, septum. ST, stomach. VG, visceral ganglia.

Figs. 2–6. *Guianadesma sinuosum*, holotype. (3/1). 2, Interior of left valve. 3, Interior of right valve. 4, Ventral view. 5, Exterior of right valve. 6, Exterior of left valve.

VARIABILITY, DEVELOPMENTAL CHANGES, AND DENTICLE-REPLACEMENT IN THE RADULA OF *LYMNAEA STAGNALIS APPRESSA SAY*

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In the course of other researches on *Lymnaea stagnalis appressa* Say carried out in this laboratory certain points on the morphology and functioning of the radula have come to our attention which are worthy of record, because of the importance placed by some workers on radular dentition in taxonomy. These points concern the marked variation in radular pattern in different individuals, the development, wear, loss, and replacement of radular denticles throughout the life of the snail, and the elimination of the discarded teeth through the alimentary tract.

Historical. Hoffmann (1932) described the formation of the radula in *L. stagnalis*, reviewed the controversial issues of earlier writers, and concluded that, once the odontoblastic cushion is built, it is permanent and fixed and each odontoblast produces all of the teeth of one longitudinal row in the radular ribbon. He observed that the part of the radula which has only recently separated from the odontoblastic cushion is soon joined firmly to the subradular epithelium by the secretion of the subradular chitin. He stated also that the radula probably does not pass out over the subradular epithelium by an independent movement,

but rather by a relative displacement of the radula out of the radular sac as a consequence of the growth of the entire buccal mass. Cawston (1928, 1930, 1940) asserts that lymnaeids add new rows of teeth from the nascent posterior border of the radula; that the number of tricuspid teeth is increased by coalescence of the cusps of the marginal teeth; that older snails have more rows of worn anterior teeth and also a greater number of total rows of teeth than younger snails; and that shedding of molluscan teeth is a less frequent process than is commonly supposed! He counted 500 teeth in the radula of *Bulinus tropicus* at hatching time, and in a few weeks the number of teeth increased from 7,000 to 10,000, a number which he believed remains fairly constant throughout the life of the snail. Pruvot-Fol (1926) describes the first very small teeth observable on the anterior portion of the radula as the teeth of the preradula, which, she writes, are the first formed set of embryonic cusps and are noted most prominently in Pulmonata. The radulae of other snails have been studied by Bowell (1924) and by Howe (1930, 1938). The latter worked on Pleuroceratidae and found a distinct increase in the size of the teeth concomitant with the increase in size of the shell. He concluded that in this family the radular formulae are not safe criteria for specific diagnosis. He maintained that the size of the snail should always be stated when the radula is to be used for purposes of classification.

Methods. Fresh radulae were dissected from recently killed snails and mounted temporarily in distilled water for study. For permanent radular mounts the radulae were removed from the buccal mass with a minimum of muscle tissue and digested in 10% KOH for one to two days at room temperature. When clean they were rinsed and stained in 1% chromic acid for 10 to 15 minutes, run up through the alcohols including absolute alcohol, and mounted in Seiler's alcohol balsam (Lee, 1937).

By the method of Campbell (1929) the radulae were found to be composed of chitin. Further, after heating in 88% alkali at 160° C. for 15 minutes, and staining, the radulae appeared visibly unchanged, indicating the high content of chitin. Spek (1921) has shown the radulae of *Helix* and of *Arion* to be composed mainly of chitin.

Variation of the Dentitional Pattern. F. C. Baker (1928) gives the radular formula of *L. s. appressa* as follows:

$$\frac{24}{3-4}-\frac{3}{3}-\frac{19}{2}-\frac{1}{1}-\frac{19}{2}-\frac{3}{3}-\frac{24}{3-4}.$$

Examination of 20 radulae of *L. s. appressa* taken from (1) approximately the tenth laboratory generation of snails collected originally in Fox Lake, Wisconsin, (2) recently collected Fox Lake snails, and (3) native snails from Lake Metonga, Wisconsin, has disclosed a wide variation in the radular dentition not indicated by Baker's formula. These 20 snails varied in shell length from 33 to 46 mm. The maximum and minimum numbers of lateral, intermediate, and marginal teeth, respectively, found in the radulae of these snails were as follows: (1) laboratory Fox Lake: 14–19, 2–5, 21–30; (2) native Fox Lake: 18–25, 3–4, 23–28; and (3) native Metonga: 15–25, 1–5, 13–28. F. C. Baker gives the following figures for three different subspecies of *stagnalis: L. s. appressa* (1911, 1928): 19, 3, 24; for the same snail in 1902: 13, 4, 29; *L. s. lillianae* (1928): 15, 8, 16; and for *L. s. sanctaemariae* in the same year: 18, 4, 24.

In almost every transverse row of teeth in the radulae examined the first lateral tooth was distinctly tricuspid, and occasionally some of the other laterals exhibited three cusps. In contrast to this Baker (1928) points out that "No tricuspid first laterals have been seen in any American specimens of this species" (*stagnalis*). There appeared also considerable variation in the number of longitudinal rows of lateral teeth on both sides of the same radula: a difference of three rows was not uncommon, and a maximum difference of seven rows was noted in one case. The average number of intermediate teeth was three. The median unicusp was constant throughout. The number of marginal teeth was usually the same on either side of the same radula. The number of transverse rows of teeth varied in the snails from the different localities: on the average in the native Fox Lake *L. s. appressa* about 100 rows; in the tenth generation laboratory Fox Lake snails, 120; and in the native Lake Metonga snails, 140. The milder environmental conditions in the laboratory may reduce the loss of teeth, and possibly accounts for the greater number of transverse rows of teeth of the laboratory snail over the same snail in its natural habitat. The number of teeth in each trans-

verse row was roughly 100, but varied considerably even in snails of the same length. No deviation was observed in the parallel arrangement of the longitudinal rows of teeth. Evident here and there along the longitudinal rows was the gradual transition of the marginal teeth to the lateral teeth; marked transition in any one radula was not observed, but quite noticeable was the fact that the teeth did not pass gradually and imperceptibly from one form to the other, but that a vacillation occurred in which there appeared a periodic recurrence of the marginal tooth characters; towards the nascent end of the row the recurrence displayed the recapitulation less intensely with each repetition. The dimensions of the radulae varied from 6.0 × 2.5 to 4.0 × 2.0 mm., and there was a fair correlation of radular dimensions with the number of transverse rows of teeth and the number of teeth in the transverse rows.

These radulae exhibited a series of morphological types in each transverse row of teeth. These are listed here beginning with the extreme marginals and leading in to the median tooth: (1) the relatively small and inconspicuous marginal rounded knobs which elongated, becoming quite slender and developed minute cusps; (2) the midmarginals in which the cusps reached their maximum number and then started to decrease again as the tooth shortened; (3) the intermediates where the tooth shortened to the length maintained by the laterals; (4) and finally the laterals in which all of the cusps of the marginals merged (or perhaps became reduced) to the average number of two. The first lateral increased the number of cusps again to three; the median tooth retained the unicuspid condition. Occasionally an entire longitudinal row of lateral teeth was met which was completely unicuspid, indicating, with what has been described above, the general tendency of the teeth to take on the unicuspid shape.

A glance at the numbers of the different kinds of teeth in various specimens of *L. s. appressa*, and in the related subspecies given by Baker, indicates to some extent the marked variation and overlapping of the numerical limits of the different teeth in the radulae of the subspecies of *Lymnaea* represented, and also in the individuals of *L. s. appressa* itself.

Wear, Loss, and Replacement of Teeth. The first nascent posterior transverse row of teeth in these radulae appeared as a vague

transparent image; proceeding forward the teeth became gradually transformed into the fully hardened chitinous denticles. The teeth in the first transverse row on the anterior margin of the radula had been reduced to rounded stubs by constant wear. Posteriad for approximately 25 transverse rows the teeth displayed progressively less wear. The anterior border of the radula was rounded and not squared as one might expect from the fact that the teeth in each transverse row are produced simultaneously. The rounding is effected by the earlier loss of the more weakly attached marginal teeth.

Evidence for the fact that teeth are dropped from the radula was found in the examination of fresh radulae and of fecal pellets. In fresh radulae the scars of 4 to 5 denticular plates of attachment in the radular membrane were evident anterior to each of the last attached anterior teeth.

Microscopic examination of the fecal pellets of a normal 40 mm. snail over a period of 23 days showed that a surprisingly large number of radular teeth are dislodged daily, swallowed, and passed out in the fecal material. This snail was isolated in a two-liter glass container containing a half inch mesh paraffined metal screen over the bottom which permitted the feces to collect there undisturbed by the snail; snails commonly consume their own feces. That this snail was a normal one was indicated by the fact that it oviposited three egg capsules and added 2 mm. to the length of its shell during the experiment. Moreover at the conclusion of the experiment, dissection revealed that the radula was normal in all respects. A total of 613 teeth of all types was discarded in 23 days as follows (days in parenthesis): (1) 1, (2) 1, (3) 0, (4) 0, (5) 16, (6) 0, (7) 75, (8) 0, (9) 7, (10) 16, (11) 42, (12) 42, (13) 25, (14) 4, (15) 60, (16) 59, (17) 24, (18) 33, (19) 95, (20) 65, (21) 26, (22) 15, (23) 7. Random samplings of the fecal pellets of other snails also showed the presence of discarded teeth.

Further evidence for the theory that the radula is constantly growing forward (although no explanation as to how the radula passes forward is attempted here) and discarding the old worn teeth, and that the teeth in each transverse row undergo a "metamorphosis" from the primary marginal tooth to the laterals, was found in a study of the radulae of a series of consecutively older and larger laboratory snails. The shell length of the snails used

varied from 5.5 to 41.0 mm. and the ages from 45 to 115 days (Table I). The tabulation in Table II shows that the median tooth remained unicuspid and constant throughout, and that the

TABLE I

Variation of Certain Characters of *L. s. appressa* with Age and with Shell Length

Characters	Snails				
Number of snail	1	2	3	4	5
Age, days	115	95	95	85	45
Shell length, mm.	41.0	23.5	18.0	10.0	5.5
Spire length, mm.	22.0	12.0	8.5	5.0	2.5
Aperture length, mm.	19.0	11.5	9.5	5.0	3.0
Aperture width, mm.	12.0	6.5	5.0	2.5	1.5
No. shell whorls	7.5	6.5	5.5	5.0	3.5
Number of transverse rows	125	103	98	74	74
Length of 1st. lateral, in μ	60	44	38	24	15
Radular dimensions, mm.	2.2×4.5	1.5×3.0	1.0×2.5	0.7×1.4	0.4×1.1
Total no. of teeth per radula	10,375	6,695	6,566	4,218	3,034

TABLE II

Variation of the Radular Formula of *L. s. appressa* with Age and with Shell Length

Types of Teeth	Number of Teeth									
Number of snail	1		2		3		4		5	
	P*	A**	P	A	P	A	P	A	P	A
Marginals	21	22	18	18	20	20	19	19	12	12
Intermediates	4–6	4–6	3	4	5	4	2	2		
									9	8
Laterals	15	15	11	10	8	8	7	7		
Median	1	1	1	1	1	1	1	1	1	1
Laterals	16	16	10	10			8	8		
					13	12			8	7
Intermediates	4–5	4–5	4	4			2	2		
Marginals	21	21	18	17	20	20	18	18	12	13

* Posterior portion of radula; ** Anterior portion of radula.

number of intermediate teeth varied only within the limits of 2 to 5. With increasing size and age of snails there was a progressive increase in the number of lateral and marginal teeth, the length of the first lateral (measured from the tip of the cone to the anterior edge of the plate of attachment), the width and the length of the radula, the number of transverse rows of teeth, and the number of teeth in any transverse row. Inspection of the form of the individual teeth through the series shows vividly the increase in the total number of teeth with age, and the "metamorphosis" of the marginals to the laterals. In the youngest snail (No. 5) no laterals were yet formed, and the radula was consequently divisible into two regions only: marginals and intermediates. The intermediates were all distinctly tricuspid and in form were about midway between the intermediate teeth and lateral teeth. In the 10 mm. snail (No. 4) the complete separation into the laterals, intermediates, and marginals had already taken place. The first lateral on either side of the median tooth persisted through all radulae examined as the tricuspid intermediate form. The right laterals and intermediates of the radula of the 18 mm. snail (No. 3) were so intermixed that the two regions could not be delimited. The nascent half of the left side of this same radula showed clearly a transition from the marginals to the intermediates in one longitudinal row of teeth; a similar transition was shown in the right side of the same radula. In the radula of the 23.5 mm. snail (No. 2) the nascent left end showed one more longitudinal row of laterals than the anterior end, thus indicating transition from the intermediate to the lateral form.

The successive teeth down any longitudinal row in a given radula do not vary perceptibly in length. The length of the individual teeth of the snail, for example of the first lateral, increases from 15 μ in a 45 day old snail to 60 μ in a 115 day old snail. This suggests a sufficient production of and subsequent discard of teeth such that the length of the teeth in any longitudinal row of the radulae of various sized snails remains fairly constant.

Summary. (1) The variation in the radular dentition in the subspecies of *Lymnaea stagnalis* mentioned here seems to make the use of radular formulae undependable, at least for subspecific diagnosis. Because of the change of the denticular pattern with

the size of the snail, the radula would be a more reliable tool in classification when used with snails of known dimensions. (2) It is suggested that in the youngest snails the radula is probably formed by a few rows of marginal-like teeth produced by relatively few odontoblasts. With increase in age, the odontoblastic cushion grows laterad producing an increasing number of longitudinal rows of teeth. Each portion of the odontoblastic cushion which produces each longitudinal row of teeth progressively differentiates to produce successively the series of types of teeth found across a transverse row in the adult snail radulae. (3) Finally, there is indicated a remarkable turnover of teeth, a rate of production and discard far exceeding earlier estimates.

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NEW SPECIES OF CERION, NENIA AND DRYMAEUS

By MAXWELL SMITH

Cerion deani, new species. Plate 7, figure 7.

Shell small, subcylindric-ovate, translucent, rimate perforate, ground color cream-white, surface shining, ornamented with longitudinal chestnut colored flames which are about equal in area to the light ground. Longitudinal growth lines numerous, rather fine, slightly oblique. Spire somewhat swollen as com-

pared with body-whorl, post-nuclear whorls 6½, nuclear whorls 2, the latter flesh color, the former slightly convex. Suture moderately impressed, occasionally slightly puckered. Parietal lamella strong, deeply placed, light in color, axial lamella indistinct when present. Peristome of the cream ground color, the terminals somewhat distant from one another, no change of color pattern visible upon the parietal wall. Exterior chestnut colored pattern visible within the aperture.

The holotype, together with a good series, were received from Paul Dean Ford, of Nassau, Bahamas. They were collected at "The Current," south tip of Abaco, Bahamas. The holotype, in the collection of the author, measures: Length 16 mm.; diameter 6 mm.

Cerion deani is closely allied to *C. marmoratum* (Pfeiffer) from Fortune Island where it was collected by John B. Henderson Jr. and Charles T. Simpson. The new species is first of all much smaller, the post nuclear whorls fewer in number, the aperture not so elongate and much more obliquely extended. Furthermore in *C. marmoratum* there is a tendency toward a continuous peristome by the presence of a sharp edge of enamel connecting the terminals of the lip. In *C. deani* this character is practically absent.

Cerion pauli, new species. Plate 7, figure 8.

Shell of moderate size, extremely narrow, solid, rimate perforate, ground color whitish or cream, surface with a silk-like lustre, ornamented with chestnut colored longitudinal flames which cover less than one-half the surface. Sculpture consisting of slightly oblique longitudinal growth riblets of varying size, a few of which suggest slight varices, becoming more oblique upon the body whorl. Spire somewhat swollen near center, post nuclear whorls 10, slightly convex, each whorl keeled anteriorly adjacent to the suture and forming an "overhang." Suture deep, beyond the first five whorls slightly descending, especially toward maturity. Nuclear whorls 3, the second the largest, cream color with a pearl-like sheen. Parietal lamina strong, slight indications of lamina upon axial wall. Aperture angulate above, obliquely extended, exterior of extension adjacent to the axis characterized by several previous lip formations which stand out prominently. Peristome continuous, outer edge somewhat

pointed adjacent to suture, with in certain individuals a previous labrum outside and which at its termination is bifurcate.

The holotype, together with other specimens were collected on Stewart Manor Hill, Exuma (main island), Bahamas. The holotype, in the collection of the author, measures: Length 23 mm.; diameter 4.5 mm.

Cerion pauli is the most slender Cerion so far discovered. No other species seems to approximate it. A study of the anatomy may reveal that it should be placed in a new genus or subgenus. A few examples of this species lack the chestnut colored flame-like markings, being of a uniform light color.

The two new Cerions are named in honor of Paul Dean Ford the well known malacologist of Nassau, Bahamas, President of The Bahamas Conchological Society, who supplied the specimens.

NENIA JUNINENSIS, new species. Plate 7, figure 9.

Shell fairly solid, fusiform, sinistral. Early whorls brownish-flesh color, later covered with a thin brownish cuticle which exhibits a faint sheen. Sculpture consisting of numerous longitudinal wavy interrupted riblets which have the tendency to become more plentiful and crowded anteriorly at the suture. Spire broadest in the middle, whorls 7½, slightly convex. Nucleus whitish and tilted slightly to one side. Suture moderately impressed.

The superior lamella is high, shaped like the bow of a boat when viewed from outside, continuous with the spiral lamella, which in turn is strongly developed. The lunella is deeply curved, the visible portion trowel shaped. The aperture is well extended from the body whorl, peristome continuous and well spread out adjacent to and below the lamella. Interior of sperture and the peristome ivory-white.

Three examples, including the holotype, are in the collection of the author. The holotype measures: Length 30 mm., breadth 7 mm. Collected at an elevation of 1100 meters in the Department of Junin, Province of Jaugo, Peru.

DRYMAEUS INCA, new species. Plate 7, figure 10.

Shell of moderate size, perforate rimate, rather thin, ground color yellowish-white, shining, ornamented with streaks or masses

of grayish-brown with occasional narrow lighter interspaces. Growth lines the dominant sculpture, chiefly on the body whorl, crossed by more or less distinct fine, incised spiral striation. Spire conic, apex flattened. Whorls 5¼, slightly convex, body whorl very large. Suture indistinct, its terminal slightly ascending behind the lip. Aperture large, well exceeding half the total length of the shell, showing the external pattern inside. Peristome broadly expanded throughout. Columella almost straight with axis. Base flattened below the carina.

The holotype and several examples are in the collection of the author. The holotype measures: Length 30 mm., diameter 18 mm. Collected at an elevation of 1100 meters in the Department of Junin, Province of Jaugo, Peru.

Drymaeus inca is allied to Drymaeus expansus (Pfeiffer). The spire of the new shell is much shorter than that of D. expansus, the posterior termination of the peristome being much more removed from the suture than in the latter species. Further the color pattern and the shape of the aperture are distinguishing characters.

NOTES ON THE NAMES POTERIA, PTYCHOCOCHLIS, AND APEROSTOMA

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and
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Dr. H. Burrington Baker, in a recent number of The Nautilus (vol. 56, no. 4, April, 1943, pp. 135–137), has questioned the use of *Ptychocochlis* Simpson as a valid group name in the Cyclophoridae, claiming it is a synonym of *Poteria* Gray, 1850. He has also dissented from the concept of *Aperostoma* as recently used by Bartsch, U. S. National Museum Bulletin 181, 1942, p. 124. That our silence may not be regarded as assent, we are stating our position as clearly and briefly as possible.

Ptychocochlis was proposed by Simpson (Proc. U. S. Nat. Museum, vol. 17, 1894, p. 431 (1895) as a substitute for "*Platy-*

stoma Klein applied by Fischer and Crosse . . . several times preoccupied." Fischer and Crosse (Miss. Sci. Mex. Rech. Zool., vol. 2, pp. 149–150, 161, 1888) applied the name *Platystoma* Klein (already used in 1860 by Mörch for a different group) "à un groupe . . . dont Chemnitz a designé le type sous le nom de *Turbo jamaicensis*" (*l.c.* p. 150) and again "une forme très-voisine, mais distincte, prise pour type du genre *Platystoma* de Klein, le *P. jamaicensis* Chemnitz" (*l.c.* p. 161). Before this, in 1885, Fischer (Man. de Conch., p. 744) had used *Platystoma* Klein as a section of *Aperostoma*, with the sole species "*P. jamaicensis*, Chemnitz."

The type, therefore, of *Platystoma* Klein of Fischer 1885 and Fischer and Crosse 1888, and that of *Ptychocochlis* Simpson 1895, is the *Turbo jamaicensis* of Chemnitz, whatever their concept of that species may have been (see Opinions of the International Commission of Zoological Nomenclature, nos. 14 and 65).

The type of *Poteria* Gray, 1850, is *Turbo jamaicensis* Wood (Index Test., ed. 2, Suppl., p. 18, pl. 6, *Turbo*, p. 3). This species is quite different from the Chemnitzian form as a comparison of the figures will show. Chemnitz mentions, and his figure depicts, the "very many wrinkles and fine folds at the suture and near the high edge which surrounds the deep funnel-shaped umbilicus like a wall." The description of the operculum is too general and his figure of it too poor to be of much value. Wood's figure, on the other hand, shows no corrugations and only a weakly expressed umbilical carina. If Wood's species had been more strongly sculptured, the artist would surely have shown this, as he did quite adequately the corrugations in the figures of other sculptured shells in the same work.

In spite of these evident differences, these two species have been confused and synonymized by most later authors. Pilsbry and Brown in 1910 (Proc. Acad. Nat. Sci. Philadelphia, 1910, p. 534) called attention to the fact that "the species long known as '*jamaicensis* Chemnitz' is certainly not the Chemnitzian form, which was really *portlandensis* of Chitty."

Considering these facts we believe that the identification of these two forms as given by Bartsch (Bull. U. S. Nat. Museum, no. 181, 1942, pp. 93, 112) is reasonable and logical. Only an

examination of the type of Wood's species in the British Museum can definitely settle the question.

Bartschivindex H. B. Baker, 1943, becomes, therefore, in our opinion, a synonym of *Ptychocochlis* Simpson.

The Type of Aperostoma Troschel 1847

Troschel in the Zeitschrift für Malakozoologie, vol. 4, 1847, p. 44, proposed the genus Aperostoma, naming as the examples: volvulus Lam., mexicanum Menke, and blanchetianum Moricand. The type of the genus must of course be one of these three.

Pfeiffer in the article immediately following states that in his opinion "Aperostoma still embraces two heterogeneous elements, namely, shells with a heavy calcareous and others with a thin, horny operculum. I would restrict the genus Aperostoma to the first i.e. those with a calcareous operculum, and I would revive for the others Montfort's name Cyclophorus, whose type in Cyclostoma volvulus Müller." To the two named species left in Aperostoma thereby he adds six more species.

Aperostoma blanchetianum was known to have a calcareous operculum, and the operculum of mexicanum was unknown (Pfeiffer states this in Zeitschrift für Malakozoologie, vol. 4, 1847, pp. 103, 104), but he placed that species in Aperostoma.

Since Pfeiffer as first reviewer restricted Aperostoma to cyclophorid mollusks having a calcareous operculum, and since blanchetianum is the only one of the three original species having such an operculum, that species should have been selected as the type.

To preserve the genus Aperostoma as it was used by the first revisor nearly one hundred years ago and as it has rather generally been used until quite recently, we propose to present the case to the International Commission on Nomenclature, with the request that they rule A. blanchetianum Moricand the type of Aperostoma Troschel.

PAPUINA GARTNERIANA PFEIFFER

By WILLIAM J. CLENCH

There has been considerable confusion concerning this as well as allied species from Northern Australia and the East Indies. In the same paper Pfeiffer described both *Papuina gartneriana*

and *P. poiretiana* from the Cuming collection, the former with the locality unknown, and the latter as coming from Port Essington, Northern Territory, Australia. According to J. C. Cox, *P. gartneriana* came from Port Essington and *P. poiretiana* came from Night Island off the northeastern Queensland coast.

It would appear to be exceedingly doubtful if either came from Port Essington. The figure of *P. gartneriana* is probably overdrawn and may well represent a slightly malformed specimen which had led Pfeiffer astray in his original diagnosis.

We have specimens originally from J. C. Cox bearing the name of *poiretiana* from Night Island and a specimen labeled *gartneriana* from "Northern Australia," originally from Dohrn who had purchased Pfeiffer's collection. Both the specimens of Cox and Dohrn are indistinguishable.

Later, Tapparone Canefri had listed *gartneriana* as a questioned synonymn of *Papuina blainvillei* Le Guillou from the Aru Islands off the southwest coast of New Guinea. Unfortunately subsequent writers accepted this relationship without question and the error has persisted. *Papuina blainvillei* and *P. gartneriana* are quite distinct.

The following account is by John Macgillivray, Naturalist to the Expedition (Narrative of the Voyage of H. M. S. *Rattlesnake*, 1852, 1, pp. 115–116) who had originally collected the shells that Pfeiffer described through Cuming.

"On September 8th [1848] we anchored to the westward of the North end of Night Island, a mile off shore, and remained there for the two succeeding days. This island is two miles in length, and a half a mile in breadth, surrounded by a narrow reef of dead coral and mud. . . . the place is densely covered with mangroves. A sandy portion, of about five acres in extent, is thickly covered with bushes and small trees. . . . Even this small spot produced a fine white *Helix*, not found elsewhere,—it occurred on the branches of the cotton trees."

An outline of the literature follows:

PAPUINA GARTNERIANA Pfeiffer

Helix gartneriana Pfr. 1851, Proc. Zool. Soc. London, p. 253 (locality unknown).

Helix gaertneriana Pfr., Reeve 1851, Conch. Icon. 7, pl. 79, No. 419 (Night Island, North Australia); Forbes 1852, [in] J. Mac-

gillivray, Narrative of the Voyage of H. M. S. *Rattlesnake*, London, 2, p. 372 (Night Island); Pfeiffer 1854, Conchy.-Cab. 1, pt. 12, sec. 3, p. 402, pl. 145, fig. 1–2 locality unknown); J. C. Cox 1868, Mono. Australian Land Shells, Sydney, p. 66, pl. 11, fig. 11 (after Reeve) (Port Essington).

Helix poiretiana Pfr. 1851, Proc. Zool. Soc. London, p. 254 (Port Essington); Reeve 1852, Conch. Icon. 7, pl. 79, No. 418 (Port Essington); Pfeiffer 1854, Conchy.-Cab. 1, pt. 12, sec. 3, p. 372, pl. 140, fig. 5–6 (Port Essington); J. C. Cox 1868, Mono. Australian Land Shells, Sydney, p. 66, pl. 2, fig. 1 (Night Island, N. E. coast of Australia).

Helix (*Papuina*) *blainvillei* Pilsbry 1891, Man. of Conch. (2) 7, p. 25, pl. 8, fig. 57–58, pl. 9, fig. 75–76 [description and these figures] not *Helix blainvillei* Le Guillou 1842, Revue Zoologique, p. 140 (Aru Islands).

Helix (*Papuina*) *poiretiana* Pfr., Pilsbry 1891, Man. of Conch. (2) 7, p. 27, pl. 8, fig. 46–49 (Night Island, N. E. Australia).

In addition to Night Island, we possess three specimens of *gartneriana* collected by P. J. Darlington along Lankelly Creek, McIlwraith Ranges, Cape York, Queensland. This mountain range parallels the coast a short distance inland opposite Night Island. This island is 13 miles north of Cape Sidmouth, Queensland.

NOTES AND NEWS

Olof O. Nylander.—We are grieved to record the death of this veteran Maine naturalist on July 30. An account of his life and work will be given later.

Dr. Merrill Moore is at present serving as a Major in the Medical Corps of the Army. He has recently been assigned to foreign duty as Chief of the Psychiatric Service of the 39th General Hospital (Yale Unit) with the American Expeditionary Forces overseas.

Sinistral Pomacea.—In my rambles a few days ago I found in a private pond here, a fine live specimen of *Pomacea paludosa* (Say) which was *sinistral*. Is this of very rare occurrence or are they found occasionally? I never heard of one before, and others in Florida say the same.—D. L. Emery, 121 Twentieth Ave. So. St. Petersburg, Fla.

A Source of Misleading Molluscan Records.—During nine years of collecting marine mollusks on Cape Ann, Massachusetts, the writer found that one of the best locations for finding washed-in shells was a sandy shore known as Pavilion Beach on the northern shore of Gloucester Harbor. It was at first believed that many of these shells would give a good indication of the molluscan fauna of Gloucester Harbor and vicinity. Later, a number of species thus suspected were actually collected or dredged from the subtidal region of Cape Ann (i.e. *Colus stimpsoni* Morch, *Neptuna decemcostatus* Say, *Buccinum undatum* L., *Modiolus modiolus* L., *Arctica islandica* (L.), *Spissula solidissima* Dillwyn, *Venus mercenaria* L., *Petricola phaladiformis* Lam.). Others, however, were not, and this led to an investigation which showed the possible misleading character of such collecting. Large numbers of *Ostrea virginica* Gmel., *Pecten irradians* Lam., *Anomia simplex* Orb., and *Cepaea hortensis* (Müll.) and occasional shells of *Busycon canaliculatum* Say and *Pecten grandis* Solander were found. While *Cepaea hortensis* is an introduced land form, it has been reported as "very abundant on Salt Island, near Gloucester" by Gould and Binney,[1] and often near the shoreline. Cape Ann is within the range of all of the others except *Busycon*, although the writer has not been able to collect live specimens from this region. The fact that all the species are edible forms gave the clew which was later substantiated. In back of the beach is an Italian settlement and the above mollusks were popular items of food, the shells being scattered over the beach to dispose of them. Even many of the shells of local species have found their way to the strand in this manner. It had been taken for granted that shells of *Mya arenaria* L. had thereby reached the beach, but the others were not at first suspected. These shells were also found buried in the sand to a depth of several inches. Hence this beach might be somewhat compared to the well known kitchen middens of the American Indians. Should these shells become fossilized they might lead to a false record in the distribution of such species. While the disposition of marine shells of food mollusks is common on land and offers no problem, the accumulation on the intertidal zone, especially close to the normal

[1] Gould, A. A. and W. G. Binney 1870. Report on the Invertebrata of Massachusetts.

range of certain species might easily lead to a misinterpretation.—Ralph W. Dexter, Kent State University, Kent, Ohio.

An Interesting Variant of Venus Campechiensis.—The appearance of a new, striking, apparently hereditary, character in a molluscan shell is of unusual interest. The matter was brought to my attention by Mr. D. L. Emery of St. Petersburg, Florida, who transmitted to us five specimens of *Venus campechiensis* Gmelin for determination. These all have, on the inside of both valves, an elevated sharp ridge passing from the umbo obliquely backward toward the pallial sinus; in some of the specimens it almost reaches this. The fact that this character is present in a number of individuals suggests hereditary transmission and makes one wonder what its ultimate fate may be. Mr. Emery states that some of his friends have additional specimens with these characteristics. They were all taken near St. Petersburg, Florida.—Paul Bartsch

The Type of Euamnicola Crosse and Fischer.—In their "Mission Scientifique au Mexique, Moll." vol. 2, p. 254 on, Crosse and Fischer included the species now referred to *Lyrodes* in *Amnicola* as a second section. While they give 1840 as the date of *Amnicola*, they quote Haldeman's brief notice on the third cover page of the Monograph, pt. 1, and apparently overlooked his note on page 3, in the matter under *Paludina*. They therefore take Gould's 1841 work to be the first mentioning any species of the genus, and accept *A. porata* (Say) as the type. *A. lustrica* (Say) is not contained in their list of N. A. species, and is not mentioned by them except that incidentally in a footnote they state that Haldeman's figure of *A. limosa* was reproduced by W. G. Binney "under the name of *A. lustrica*." [1] It is obvious therefore that "*Amnicola* Gould and Haldeman" of Crosse and Fischer applied to the group typified by *A. porata* Say, and not to that based upon "*P. lustrica* Say."

On page 261 Crosse and Fischer divide *Amnicola* into two sections, the first being "*Euamnicola* Crosse and Fischer (ou

[1] "*A. lustrica*" used by W. G. Binney under his (L. and Fr.-W. Sh. N. A. III) fig. 160, was evidently a typographical or pen error for *limosa*. It is wholly unlike Binney's "*Pomatiopsis*" *lustrica* on p. 94.

Amnicola sensu stricto)." That is, *Amnicola* as understood by them, with the type *porata*. That species, *Amnicola porata* (Say), is therefore designated type of *Euamnicola* C. & F. *Euamnicola* thus remains exactly equivalent to *Amnicola*, as Crosse & Fischer intended, since Haldeman's first genotype, "*P. lustrica* Say," was, as he afterward acknowledged (in synonymy of *A. limosa*), an erroneous determination of *A. limosa* Say, of which *porata* Say seems to be an obese extreme—in fact, the end term of a contour cline.—H. A. Pilsbry.

Shell Heaps of the Herring Gull—The food habits of the herring gull, *Larus argentatus smithsonianus* Coues, are extremely varied. Best known and most important economically are the scavenging activities of this bird which does much to keep the harbors and shore lines free from excessive organic debris. The herring gull also feeds on a great variety of invertebrates, alive as well as dead. One of its feeding habits is to collect large mollusks, carry them high over rocks on which they are dropped to break the shells, and then the bird flies down to feed on the soft parts. Certain rocks or groups of rocks are often used habitually for this purpose, and in time accumulate large quantities of shells. Some of these shell heaps are above high water line, and occasionally at a considerable distance from the shore. One shell heap investigated during the summer of 1935 on a tidal inlet at Gloucester, Massachusetts, was located on an exposed ledge near spring high-water line in a salt marsh. The greater bulk of shells was made up of *Mytilus edulis* L., the blue mussel, and *Modiolus demissus* (Dillwyn), the ribbed mussel, both of which were very abundant. Somewhat less numerous were shells of *Mya arenaria* L., the soft shell clam, and *Littorina litorea* (L.), the English periwinkle. Several shells of *Polinices heros* (Say), the sand-collar snail, were also found. These represent the most numerous, the largest, and the most accessible mollusks in the nearby inlet. For a complete list see the Nautilus 56 (2): 57–61. Shells of *Mya arenaria* would undoubtedly have been more numerous if the population of this species had not suffered such a drastic decline in the season of 1934. Some of the older shell heaps are composed very largely of the shells of *Mya arenaria*.—Ralph W. Dexter, Kent State University, Kent, Ohio.

Mussel Poisoning on the Pacific Coast.—The source of the poison is a microscopic marine organism called *Gonyaulax catanella* which at times occurs in sea water in enormous numbers. The mussel ingests this organism, along with the rest of the plankton elements which form its food, without suffering harm; but the human being who eats the mussel may die, if the numbers of *Gonyaulax* in its digestive tract are sufficiently abundant. The chain then is a very simple one: the poisonous *Gonyaulax* goes into the mussel, which it does not harm, and then with the mussel into the human being, which it does harm. The mussel is merely a vehicle for the transportation of *Gonyaulax* from the sea water into the human. Pismo clams and Washington clams have at times been found to contain this organism, but mollusks which live in lagoons and situations remote from the open sea are protected from contact with it. The abalone does not feed on plankton, and is therefore free from it.

There is no way of distinguishing poisonous from sound mussels by their appearance, or by their behaviour while cooking. Heat does not destroy the poison. *Gonyaulax* is much more abundant along the California coast in the summer months than at other times, all recorded poisoning cases having occurred between May 15th and October 15th. According to Drs. Sommer and Meyer, there is one simple, safe rule: "Do not eat the viscera (dark meat) of, nor drink the juice from mussels, clams or similar shellfish from the open Pacific Coast between the first of May and the first of November."—Brian Curtis, in *California Fish and Game*, 29: 151).

Further Remarks about Labels.—The article about the human element in writing labels by Calvin Goodrich in the April number of THE NAUTILUS appeals to me and prompts me to report a few that have come to my attention. Recently, I came into possession of a collection of shells that had been assembled by the official in charge of prohibition enforcement in San Diego. His official activities were duly entered in a card catalog, and after repeal the cards were made to do duty as labels for the shell collection. Thus, occasionally one is confronted by a label reading like this: "*Engina lincata* Reeve, Loyalty Islands. John Doe arrested with Richard Roe." This form is occasionally varied, and we find: "*Corbicula insularis* Prime. Taihoku, Formosa.

John Doe arrested with Mrs. Richard Roe." Sometimes, however, John Doe succeeded in evading arrest, with a result like this: "*Helicostyla virgata* Jay. Philippines. John Doe, fugitive in case of U. S. vs. Blank." Finally, I may mention: "*Acteocina inculta* Gould. San Diego Bay, Calif. Dodge roadster seized in case of John Doe and Richard Roe." This is just the way the labels occur. The only alteration I have made is to substitute fictitious names, for obvious reasons.—JOSHUA L. BAILY, JR.

EPIPHRAGM REMOVAL AND FECAL STRING DEPOSITION BY HELMINTHOGLYPTA NICKLINIANA (Lea).—These observations are based on one individual of *Helminthoglypta nickliniana* (Lea) collected in June 1941 at Golden Gate Park, San Francisco. The individual was placed in a dry chamber; in three hours when it was examined a non-transparent, complete epiphragm had been secreted. Twelve hours later the snail was examined again. It had removed the first epiphragm and had secreted another. The first epiphragm had apparently been pushed aside by the foot alone, and was adhering by one point to the shell. Close examination showed that the radula had not been employed as a tool in the epiphragm removal process. This is contrary to observations made on two eastern helices, *Triodopsis albolabris* (Say) and *Mesodon thyroidus* (Say), at Ithaca, New York and on the Edmund Niles Huyck Preserve, Rensselaerville, New York where it was found that both the foot and the radula were used in cutting the epiphragm away from the aperture.

The second epiphragm which was secreted over the aperture after the first had been pushed aside was transparent, thus the observer was enabled to look within the shell. This epiphragm was complete. Eighteen hours elapsed before the snail was again examined. This examination revealed that the snail had punctured the epiphragm, making an irregular opening approximately 3 by 4 mm. A black fecal string had been deposited through this epiphragm opening. Such cleanliness has not been observed by the writer among the many species of helices that he has observed aestivating. Among aestivating helices fecal strings are usually deposited between the foot and the epiphragm, thus such strings are allowed to remain within the shell until the aestivating period terminates.

Forty-eight hours after the fecal string had been deposited a ten degree maximum rise in temperature (from 70 to 80 degrees Fahrenheit) the snail formed a third complete epiphragm. This was of the same non-transparent nature as the first; both were parchment-white in color. Apparently the third epiphragm was secreted to prevent dessication (with a lowered humidity which accompanied the raised temperature) which could have taken place through the opening in the second epiphragm. In summary: three epiphragms were naturally secreted in approximately 81 hours; two of the epiphragms were parchment-white in color and were non-transparent, one was transparent; the foot alone was used in removing an epiphragm; a fecal string was deposited outside of the shell through an opening in the second epiphragm. —William Marcus Ingram

PUBLICATION RECEIVED

Johnsonia, No. 7, pp. 28, *Littorina*, by Joseph C. Bequaert. No. 8, pp. 20, *Fissurella, Lucapina* and *Lucapinella*, by Isabel Perez Farfante. These careful and well illustrated studies of genera of common occurrence will be much appreciated by collectors. In many cases there has been confusion in specific nomenclature, which is here fully discussed.—H.A.P.

The Poison Cone Shell. By Wm. J. Clench & Yoshio Kondo (Amer. Jour. Tropical Medicine 23, No. 1. 1943). The authors have brought together from many sources, the various accounts of victims of venomous *Conus*, together with anatomical notes and figures of the radula and other details of the poison apparatus of *Conus striatus*. The shells of species known to be dangerous are figured: *C. textile, C. tulipa, C. marmoreus, C. geographus* and *C. aulicus*, all of the western Pacific. A timely and useful paper.—H.A.P.

Abbreviations of Author's Names in Malacology. By Leo A. Jachowski & Donald C. Scott. Ann Arbor. Lithoprint, pp. 38. Additional to the abbreviations actually in use in conchological works, there are not a few newly composed by the authors, and many for authors practically unknown in malacology.

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CALIFORNIAN OLIVELLAS

By D. S. and E. W. GIFFORD

The following paper presents further data on *Olivella biplicata,* a species already considered in our two earlier papers,[1] and a discussion of the variation in *Olivella pedroana*[2] and *Olivella pycna.*

Olivella biplicata

On August 26, 1942, a large series of young of this species was collected at Crescent City, Del Norte County, while we were gathering *Olivella pycna.* The young *biplicata* were approximately of the same size as the *pycna,* so we garnered both species, especially since the indication in each case was the same; namely a small ridge in exposed sand, a groove in sand in pools. The larger ridges we assumed were all made by adult *biplicata.* This large series of young *biplicata* (now in the collection of Mr. Allyn G. Smith) suggests that summer is the breeding season for this species at Crescent City.

On May 22, 1943, we visited Santa Cruz, Santa Cruz County, and there saw many hundreds of this species. Large numbers were seen in tidal pools, while others were exposed by raking the sand with our fingers. In all only three very small young ones were seen. The adults, however, were apparently breeding, for we found many couples in contact. In the large series of adults observed we discovered four orange-colored individuals, but these

[1] Color Variation in *Olivella biplicata,* The Nautilus, vol. 55, pp. 10–12, 1941; Color Variation in *Olivella biplicata* in Various Localities, The Nautilus, vol. 56, pp. 43–48, 1942.

[2] We are leaving to the taxonomists the moot question of whether this species should be called *pedroana* or *baetica* (*boetica*), or whether these two names stand for two distinct species. All our shells called *pedroana* appear to be but a single species.

had more or less purple in the canal region, so that none was truly comparable to our unique orange shell from Bolinas, which lacks all trace of purple. They are, however, similar to a second [3] Bolinas orange specimen with purple in the canal region.

At Monterey, Monterey County, on November 21, 1942, there were no small young shells of *Olivella biplicata*, but a considerable number of half-grown ones was taken. Since we do not know the rate of growth of this species, we are still uncertain as to the breeding season at Monterey, but assume that it may be summer.

Our 1942 paper on color variation in this species lacks adequate series south of Santa Barbara. Hence, the following are of interest. At Anaheim Landing, Orange County, on January 31[4] and February 2, 1943, eleven adult shells were taken, one albino, the others of normal coloration. These lack any trace of orange in the aperture, but (with the exception of the albino) have much purple on the inner surface of the body-whorl. A series of 267 young shells was collected, ranging from tiny individuals with striped ventral surface to others a third grown. Out of the total of 278 specimens (adult and young) none shows orange in the aperture. Of this total sixteen are albinos, thus yielding a frequency of about six per cent. This correlates with the five per cent occurrence at Santa Barbara.[5] Sixteen dark, steel-gray, young and immature shells were taken. The remainder of the series is "normal" in coloration. The evidence seems to point to a winter breeding season at Anaheim Landing, as at Santa Barbara.

From False Bay, San Diego County, we now have a series of twenty-five. Twenty-two of these were collected by Miss Edna N. Wilson on January 21, 1943, and three by ourselves on February 3, 1943. None of these twenty-five shows any trace of orange, nor do four specimens previously recorded from Ensenada, Lower California. Two False Bay specimens are albinos, thus yielding a frequency of eight per cent, which is probably much nearer the truth than the twenty-five per cent for Ensenada

[3] The Nautilus, vol. 55, pp. 10–12; vol. 56, p. 44.

[4] Our thanks to Mr. and Mrs. John Q. Burch for taking us to this collecting ground.

[5] The Nautilus, vol. 56, p. 45.

based on one out of four specimens.[6] Eight per cent is not far from the six per cent frequency of albinos at Anaheim Landing and the five per cent at Santa Barbara. These figures (8, 6, 5) probably give an approximate idea of the frequency of albinos on the southern Californian and northern Lower Californian coast.

Apparently corroborative of a probable winter breeding season at Bolinas[7] is a considerable number of one-third grown shells collected at Bolinas on May 23, 1943. We are assuming that these may represent winter-hatched shells. However, after writing the above statement concerning May 23, we spent June 18–21, July 18, and August 15, 1943 at Bolinas in search of *Olivella pycna*. In the course of collecting the latter, we handled many young *Olivella biplicata*, which would seem to indicate a late spring, as well as a winter, breeding season at Bolinas, or perhaps the breeding is continuous through several months.

The late Mr. T. S. Oldroyd has described and figured, on the bases of shape and size, a number of "varieties" of *Olivella biplicata*.[8]

The figure (pl. 5, fig. 5) which Oldroyd presents as typical for Monterey is a bit too obese to be typical, but it does fall within the range of shapes for the locality. His figure indicates the breadth as 58 per cent of the length. Our specimens from Monterey range from 50 to 60 per cent in breadth-length index (i.e., breadth divided by length).

Oldroyd's figure (pl. 5, fig. 4) of his *Olivella biplicata fucana* yields an index of 51; his measurements (p. 118) yield an index of 50. Suggesting these in relative slimness and height of spire is our series from Port Orford, Curry County, Oregon: broadest with index of 55, narrowest 44.

Oldroyd's figure (pl. 5, fig. 6) of his *Olivella biplicata angelina* yields an index of 48; his *Olivella biplicata parva* (pl. 5, fig. 7) an index of 62. His length and breadth figures for the type, p. 119, however, yield an index of 57, suggesting that the figure in the plate has been retouched badly. From Southern and Lower

[6] The Nautilus, vol. 56, p. 45.

[7] The Nautilus, vol. 56, p. 47.

[8] Some Varieties of Western Olivellas, The Nautilus, vol. 34, pp. 117–119, pl. 5, 1921.

California our series yield the following ranges in breadth-length index: Morro Bay 51–58; Santa Barbara 50–60; Anaheim Landing 47–55; Mission Beach, False Bay 48–58; Ensenada, Lower California 49–52.

At Bolinas, Marin County, the range in breadth-length indexes is 48–59; at Tomales Bay, Marin County, 49–57; at Trinidad Head, Humboldt County, 50–62; at Crescent City, Del Norte County, 48–57; at Santa Cruz, Santa Cruz County, 52–62.

Scanning large series from various localities, one is impressed with the relative obeseness of Monterey, Santa Cruz, and Trinidad shells, the relative slimness of Port Orford, Bolinas, and southern Californian shells. The mean figures from south to north are as follows: Ensenada 50.5, False Bay 53, Anaheim Landing 51, Santa Barbara 55, Morro Bay 54.5, Monterey 55, Santa Cruz 56, Bolinas 53.5, Tomales Bay 53, Trinidad 56, Crescent City 53.5, Port Orford 49.5.

The range in shapes represented by the above breadth-length indices seems to indicate that Mr. Oldroyd dignified mere individual variations by names, rather than geographic variations. Thus, his Monterey "typical" specimen with index 58 could have come from False Bay, Santa Barbara, Morro Bay, Santa Cruz, Bolinas, or Trinidad. His *fucana* type with index 50 or 51 could have come from Port Orford, Crescent City, Trinidad, Tomales Bay, Bolinas, Morro Bay, Santa Barbara, Anaheim Landing, False Bay, or Ensenada. His *angelina* with index 48 in the figured specimen could have come from Ensenada, False Bay, Anaheim Landing, Bolinas, Crescent City, or Port Orford. Similarly, his *parva* type with index 62 from his figure, or 57 from his measurements, could have come from various places other than Point Abreojos, Lower California.

Olivella pedroana

We are using the name *pedroana* instead of *boetica* or *baetica* on the assumption that both names apply to the same species, Conrad's name *pedroana* being the earlier.

Our personally collected littoral series of *pedroana* are from Anaheim Landing, Orange County (986 specimens), January 31 and February 2, 1943, and from Mission Beach, False Bay, San

Diego County (156 specimens), February 3, 1943. Miss Edna N. Wilson, our hostess and guide at Mission Beach, contributed 419 additional specimens from that locality. Our Anaheim Landing series was increased by seven specimens from Mr. and Mrs. John Q. Burch, who had collected them in October, 1940.

The Mission Beach shells are in general larger than those from Anaheim Landing. On the whole *Olivella pedroana* has a higher gloss and more porcelaneous surface than *Olivella pycna*. The color range is much greater also, being from white (albino) to chestnut brown and deep grayish olive. The commonest colors are Ridgway's olive lake, smoke gray, and light grayish olive. Moreover, examples with pale blue coloration (mostly burn blue) were common. No xanthochroistic specimens were seen, unless one considers as such a few specimens that match buffy olive, cream buff, chamois, and cartridge buff, not all over but in patches. The pattern of brown markings in some instances suggests somewhat that of the vertical wavy lines of *Olivella pycna*, especially in some grayish-olive specimens from Anaheim Landing. Other shells of this color are virtually without markings. In some shells, particularly albinistic or pale bluish ones, the markings may take on a partial plaid or checker pattern. Dredged shells (from the Burches) are frequently reddish brown in general color, a feature noted also for dredged specimens of *Olivella pycna*. The nearest approach we have in a littoral specimen is light vinaceous gray. None of our *pedroana* has the reddish brown spot alongside the fold at the base of the columella, which is so common in *pycna*. The colors described above are not over the entire shell, but chiefly on the body whorl.

The color of the inner surface of the body-whorl varies with the color of the exterior. Albinos are white, darker shells have dark coloration on the inner surface.

Certain specimens of *Olivella pedroana* have a lip callus on the inner surface of the body whorl. It is in the form of a ridge lying roughly parallel to the lip and a millimeter or so within, but not extending for the full length of the lip. It is usually white, in which case it can be readily seen. But, whether white or blending in color with the surrounding surface, it can be felt with a pin point moved transversely over the inner surface of the shell. It occurs most frequently in False Bay specimens.

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45 per cent of them having it, as against a frequency of only six per cent in Anaheim Landing specimens. These are the only localities from which we have adequate series of specimens (575 from False Bay, 993 from Anaheim Landing).

In certain smaller series, which we have received from generous friends, the callus occurs. From Newport Bay, Orange County, a series of 72 from Mr. Allyn G. Smith shows a frequency of 4 per cent. From San Pedro, Los Angeles County, 10 fathoms depth, a series of 11 specimens from Mr. and Mrs. John Q. Burch contains two specimens with the lip callus. Three Redondo Beach, Los Angeles County, dredged series from the Burches show the following frequencies: 15 fathoms, 17 specimens, none with callus; 20 fathoms, 118 specimens, 1 with callus; 25 fathoms, 39 specimens, 1 with callus. Five specimens from San Diego Bay, also from the Burches, lack the callus.

Mr. Walter J. Eyerdam has sent us Alaskan specimens, all lacking the lip callus: 11 from Hinchinbrook Island; 12 from Drier Bay, Knight Island, Prince William Sound.

To the eye, *Olivella pedroana* is distinctly slender, *Olivella pycna* obese. Relatively stout specimens of *pedroana* and relatively slender specimens of *pycna* suggest the possibility of overlapping, but so far as our series are concerned there is no overlapping. The range of shapes, expressed by the breadth-length index, is 36 to 47 for *pedroana*, 49 to 58 for *pycna*. The proportion of lip length to shell length, however, has virtually the same range in the two species. For *pedroana* lip length ranges from 51 to 67 per cent of shell length. For *pycna* the range is 54 to 66 per cent.

The fold at the base of the columella is usually slightly reflexed in both species. It tends to be thick in *pedroana*, delicate by comparison in *pycna*. On the whole *pycna* is a thinner shell than *pedroana*.

Olivella pycna

Described as a hitherto unrecognized species by Dr. Berry,[9] this species seems to be valid, and so far as our series of specimens are concerned does not intergrade with *Olivella pedroana*,

[9] S. Stillman Berry, An Undescribed Californian Olivella, Proc. Malacological Society, vol. 21, pp. 262–265, 1935.

which is presumably its nearest relative. At least the series of more than a thousand *pycna* which we have collected alive, chiefly at Crescent City, Del Norte County, and at Bolinas, Marin County, appears distinct from a series of more than a thousand *Olivella pedroana* which we took at Anaheim Landing, Orange County, and at Mission Beach, False Bay, San Diego County. Apparently Dr. Berry has clarified the *Olivella* situation in California. We have nothing to add to his discussion of the literary references, except to remark that the four *Olivella boetica* pictured by T. S. Oldroyd [10] do not appear attributable to *pycna*, but to *pedroana*, using that name as a prior synonym for *boetica*.

The lip callus frequently present in *Olivella pedroana* is absent in all of the 1149 *Olivella pycna* in our collection. The aperture opening in *pycna* is larger in proportion to the shell than in *pedroana* which is notably slenderer than *pycna*. Also the lip callus in many *pedroana* reduces still further the size of the aperture.

In coloration, or better color pattern, *Olivella pycna* is relatively uniform. There is no such color range as in *Olivella biplicata* or *Olivella pedroana*. A single xanthochroistic *pycna* is the only departure from the normal color range. The color brownish buff described by Dr. Berry, as in the paratype which he kindly presented to us, appears chiefly in our younger specimens. Our older specimens have more of a glaucous gray or olive gray ground color.

Under date of August 1, 1943, Dr. Berry writes us: "So far as I am aware all of my paratypes, inclusive of yours, are shells collected in the living state, or if any of them were dead shells I feel sure they were not long dead. I wonder whether the difference in coloring noted by you may not be due either to the time that my shells have been cabinet or else to the fact that they were all dredged or trawled shells." Dr. Berry writes that he used Robert Ridgway, Color Standards and Color Nomenclature, 1912, in determining colors. We are using the same work in this connection.

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[10] T. S. Oldroyd, Some Varieties of Western Olivellas, The Nautilus, vol. 34, pp. 117–119, pl. 5, figures 1, 1a, 2, 3, 1921.

Our single xanthochroistic specimen is capucine buff in general color, with the vertical striping obsolete and discernible only as a slightly different tone. The interior of the aperture is even richer in color than the exterior.

The brown zigzag lines running longitudinally on the shell vary in spacing and in the extent of the zigzag or wave. In some cases the lines are veiled by glaucous gray or olive gray ground color, which seems most prevalent in the older and thicker shells. In the thin young shells the brown lines are most conspicuous and equally clear from inside or outside of the shell.

A color character, not mentioned by Dr. Berry, but occurring in 72 per cent of our specimens, is a maroon or reddish brown spot, sometimes obsolete or veiled by white, beside the fold at the base of the columella. This feature is absent in four dredged specimens from Tomales Bay, Marin County, presented to us by Mr. Allyn G. Smith; in our single specimen from Port Orford, Curry County, Oregon; and in the afore-mentioned paratype. It is present in some of the shells from other localities ranging from Morro Bay [11] in the south to Crescent City in the north.

The following are the dates and places we have collected *Olivella pycna* alive littorally: Port Orford, Curry County, Oregon, June 10, 1941, 1 adult specimen; Crescent City, Del Norte County, June 9, 1941, 7 adult specimens; August 26, 1942, 650 specimens, many immature and young as well as adults; Bolinas, Marin County, May 23, 1943, 2 adults; June 18–21, 1943, 357 adult, immature, and a few young specimens; July 18, 1943, 79 adult and half grown specimens; August 15, 1943, 6 adult and half grown specimens; Monterey, Monterey County, May 31, 1942, 24 adult and immature specimens (including the adult xanthochroistic one already mentioned); November 21, 1942, 6 adult specimens. This gives a time range from May 23 to November 21, for littoral occurrence, with the peaks of abundance at Bolinas in latter June and at Crescent City in latter August.

[11] We are indebted to Mr. and Mrs. John Q. Burch for Morro Bay and Morro Rock specimens, the latter dredged from seven fathoms.

TROPICAL CENTRAL PACIFIC *CYPRAEIDAE*

By WILLIAM MARCUS INGRAM
Mills College, California

The knowledge of the distribution of the *Cypraeidae* is here supplemented and extended by listing the species of this mollusk family occurring on specific tropical central Pacific islands. New records for Pacific islands are listed, and cowry faunas are revealed for islands from which the *Cypraeidae* have not yet been reported.

The following islands are included here in separate sections with a discussion of the reef waters about each, United States Navy Department (1933): Mortlock Islands, Caroline Island Group; Nassau Island, Pukapuka Island, Jarvis Island, Line Island Group; Baker Island, and Howland Island. The species listed here from the above islands are housed in the Bernice P. Bishop Museum, Honolulu, Hawaii. All were collected by reliable collectors.

Schilder and Schilder (1939) in the most recent published summary of the distribution of the *Cypraeidae* generally include cowries from areas and not from specific islands, i.e., "Marquesas Is., Flint I. to Palmyra I. and Johnston I." The writer believes that since so many of the published records of the *Cypraeidae* were based on collections where locality data were inadvertently mixed, that specific island lists, based on known reliable collections, are necessary to clarify the distribution of this well known family. Thus the writer's earlier work is continued in an attempt to clarify the somewhat mixed geographical distribution of the *Cypraeidae,* Ingram (1937) (1937a) (1938) (1939) (1939a) (1940). Examples of past and present mixing of cowry distributional data are found in Hawaii. The examples cited here are only incidental to the many that the writer has found in examining collections in the United States. Specimens brought into the Hawaiian Islands by the missionary ship, Morning Star, from distant islands filtered into local Hawaiian collections, when in reality they were found elsewhere in Polynesia. Published reports on Hawaiian cowries have included Morning Star material, thus giving a distorted report of the

cowries actually found in the Hawaiian Islands (Bryan, 1915), (Schilder and Schilder, 1939). In recent years specimens were brought to the Hawaiian Islands by the Pan-American colonizers from Johnston, Baker, and Howland Islands. The writer saw a number of very fine *Cypraeidae* for sale from the above islands while collecting in Hilo, Hawaii in 1937. No doubt this material will eventually filter into collectors hands as being from Hawaii, and once again the cowry fauna of the Hawaiian Islands will be distorted. One accurate and complete list of the Hawaiian *Cypraeidae* was published in 1937 (Ingram, 1937), based on personal collecting and on the collections of the following scientifically trained men who had collected in the islands for twenty years, Mr. W. G. Anderson, Mr. David Thaanum, Mr. Ted Dranga, Prof. Jens M. Ostergaard, and the late Mr. L. A. Thurston. This list has already been distorted by accepting unreliable data, namely Bryan's 1915 data (Schilder and Schilder, 1939).[1]

Cypraeidae from the Mortlock Islands, Caroline Island Group

The Mortlock Islands, Nomoi Islands, consist of three distinct groups of coral islands and reefs known as Lukunor, Satawan, and Etal. The Lukunor Islands are situated on a reef approximately eighteen miles in circuit, and enclose an oval-shaped lagoon lying in a northwest and southwest direction. Satawan Reef consists of sixty small islets surrounding an oval-shaped lagoon, about seventeen miles in length with approximately the same trend as the above island group. The Etal Islands lie to the north of Satawan, and are about seven miles in circuit. They consist of a number of low, thickly wooded islets, connected by a reef in whose center there is a lagoon.

The mollusks from these islands were presented to the Bernice P. Bishop Museum by Mr. J. S. Emerson. There are thirty-two species represented in the collection. Based on the number of

[1] Two of the specific names used by Ingram (1937, op. cit.) have correctly been placed in synonomy by Schilder and Schilder (1939, op. cit.) i.e., *Cypraca peasei* Sowerby = *Cypraca gaskoini* Reeve; *Cypraca punctulata* Gmelin was incorrectly used to refer to *Cypraca teres* Gmelin.

individuals of any one species in this collection the following are the most common: *Cypraea carneola* Linnaeus, *C. tigris* L., *C. arabica* L., *C. annulus* L., *C. moneta* L., *C. lynx* L., and *C. poraria* L.

One of the notable specimens in this collection is a large *Cypraea lynx* L. which measures approximately 73 mm. along an anterior-posterior axis. Both the white and pink base color varieties of *Cypraea mappa* L. are in the collection. The cylindrical and oval forms of *Cypraea carneola* L. are represented in the cabinet, the latter form being the so-called variety, *propinqua* Garrett. The list follows:

Cypraea annulata Gray
Cypraea annulus L.
Cypraea arabica L.
Cypraea arenosa L.
Cypraea argus L.
Cypraea asellus L.
Cypraea caputserpentis L.
Cypraea carneola L.
Cypraea caurica L.
Cypraea clandestina L.
Cypraea cruenta Gmelin
Cypraea cumingii Gray [2]
Cypraea erosa L.
Cypraea errones L.
Cypraea felina Gmelin
Cypraea helvola L.
Cypraea intermedia Gray
Cypraea isabella L.
Cypraea lynx L.
Cypraea mappa L.
Cypraea moneta L.
Cypraea poraria L.
Cypraea scurra Chemnitz
Cypraea stolida L.
Cypraea teres Gmelin [3]
Cypraea talpa L.
Cypraea tigris L.
Cypraea ventriculus Lam.
Cypraea vitellus L.
Nuclearia staphylaea (L.)
Ipsa childreni (Gray)
Pustularia cicercula (L.)

Cypraeidae from Line Islands

The cowries from Pukapuka Island were collected by Ernest Beaglehole; those from Nassau Island were taken by F. L. McFall. The collection from Jarvis Island was gathered by the members of the Whippoorwill Expedition from the Bernice P. Bishop Museum.

Pukapuka Island, one of the three Danger Islands, 10° 53′ S., 165° 49′ W., is a coral atoll with a maximum height of eighty feet above sea level. Fifteen species are in the collection from

[2] As illustrated in G. B. Sowerby, Thesaurus Conchyliorum, pl. 3, figs. 349–350, 1870.

[3] As illustrated in G. B. Sowerby, Thesaurus Conchyliorum, pl. 27, fig. 261, 1870.

this island; of these *Cypraea arenosa* L., is the most common. Two individuals, *Cypraea vitellus* L. and *Cypraea lynx* L., are extremely large. The specimen of the former species has an anterior-posterior length of 84 mm., the specimen of the latter species measures 65 mm. along the anterior-posterior axis. List follows.

Cypraea annulus L.
Cypraea arenosa L.
Cypraea fimbriata Gmelin
Cypraea intermedia Gray
Cypraea irrorata Gray
Cypraea isabella L.
Cypraea lynx L.
Cypraea mauritiana L.
Cypraea moneta L.
Cypraea talpa L.
Cypraea testudinaria L.
Cypraea tigris L.
Cypraea ventriculus Lam.
Cypraea vitellus L.
Nucleraria nucleus (L.)

Nassau Island

Nassau Island, 11° 33′ S., 165° 25′ W., is approximately forty-five miles southeast by south of the Danger Islands. A fringing reef surrounds the island. *Cypraea ventriculus* Lamarck, *Cypraea mauritiana* L., and *Cypraea poraria* L. are the most common of the species in the collection.

Cypraea arenosa L.
Cypraea caputserpentis L.
Cypraea helvola L.
Cypraea intermedia Gray
Cypraea irrorata Gray
Cypraea isabella L.
Cypraea mauritiana L.
Cypraea poraria L.
Cypraea testudinaria L.
Cypraea ventriculus Lam.

Jarvis Island

Jarvis Island, 0° 23′ S., 160° 02′ W., is a small coral island of one and eight-tenths miles in length. *Cypraea caputserpentis* L. is the most common of the nine species in the collection.

Cypraea arenosa L.
Cypraea caputserpentis L.
Cypraea intermedia Gray
Cypraea isabella L.
Cypraea lynx L.
Cypraea moneta L.
Cypraea poraria L.
Cypraea scurra Chemnitz
Cypraea vitellus L.

Cypraeidae from Baker and Howland Islands

The specimens from these islands were collected by members of the scientific staff of the Bernice P. Bishop Museum's Whippoorwill Expedition in 1924 (Edmondson, 1924).

Baker Island

Baker Island, 0° 13′ N., 176° 33′ W., is a coral island of about a mile in length. It is surrounded by a coral reef from two hundred to four hundred feet in breadth.

Cypraea cribraria L.
Cypraea erosa L.
Cypraea isabella L.
Cypraea lynx L.
Cypraea moneta L.
Cypraea poraria L.
Cypraea teres Gmelin [4]
Cypraea scurra Chemnitz
Cypraea talpa L.
Cypraea testudinaria L.
Cypraea tigris L.
Cypraea vitellus L.
Nucleania nucleus (L.)

Howland Island

Howland Island, 0° 49′ N., 176° 43′ W., possesses a fringing reef and is about two miles long. Seventeen species are in the collection, of these *Cypraea intermedia* Gray, *Cypraea caputserpentis* L., and *Cypraea mauritiana* L. are common.

Cypraea annulus L.
Cypraea caputserpentis L.
Cypraea carneola L.
Cypraea helvola L.
Cypraea intermedia Gray
Cypraea isabella L.
Cypraea lynx L.
Cypraea mauritiana L.
Cypraea moneta L.
Cypraea poraria L.
Cypraea teres Gmel.
Cypraea reticulata Martyn
Cypraea scurra Chemn.
Cypraea talpa L.
Cypraea testudinaria L.
Cypraea vitellus L.
Nucleania nucleus (L.)

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[4] As illustrated in G. B. Sowerby, Thesaurus Conchyliorum, pl. 27, fig. 261, 1870.

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A WEST AMERICAN JULIA

By H. A. Pilsbry and A. A. Olsson

As living mollusks, species of *Julia* are known in the central Pacific (*J. exquisita* Gould, Hawaii) and Indian Ocean (Réunion). Fossil forms have been described from lower to middle Miocene of Florida (*J. floridana* Dall) and the West Indies (*J. gardnerae* Woodring), and Woodring mentions three from slightly older, Helvetian and Aquitanian, French beds.

The Panamic species here described as *J. equatorialis* is the first living American species. It seems to be the smallest of these little clams now known. Its rather long and narrow anterior end is most like *J. borbonica* (Desh.), but that species differs by having a straight ventral margin. *J. exquisita* Gld., as figured by Dall, Bartsch and Rehder, differs by the same feature. According to Gould it attains a length of 5 mm.

Julia equatorialis, n. sp. Plate 9, figs. 10, 11.

Shell small, usually between 2 and 3.8 mm. in length. When fresh, the color of the shell is green or greenish yellow but on weathering it soon becomes white. The valves are moderately convex, subquadrate in form, the dorsal margin more strongly convex than the ventral; the anterior end is produced to form a short to fairly long wing, somewhat pointed at the end. Beaks prosogyrate, their position varying somewhat with the length of the anterior wing. Hinge edentulous. Lunule is deeply sunken. In the left valve its inner edge is strongly thickened so that it resembles a large rounded tooth, projecting into the valve cavity. In front of this toothlike process and below the beak it is excavated. In the right valve the lunule does not project so far inward and is not enlarged at the end, but the central part is raised, toothlike, fitting into the excavation mentioned in the lunule of the other valve. Texture of valves is somewhat trans-

lucent, the exterior smoothish, but obscurely marked with about 20 very shallow radial lines. Greatest inflation of the valves situated just back of and below the beaks.

Length 3.7 mm., height 2.7 mm. (type).

Although rare, as far as we may judge from present records, the species seems to have a general distribution through the southern part of the Panamic province, from southern Panama to northern Peru. We have specimens from the following localities:

Panama: Bucaru, at the southern tip of the Los Santos Peninsula, one specimen.
Colombia: Isla del Gallo, to the north of Tumaco, one specimen.
Ecuador: Punta Callo, on the coast west of Jipijapa, Prov. of Manabi, three or four specimens.
Peru: Caleto Sal, north of Mancora, Department of Tumbex, 2 specimens, Type 179845 ANSP.

The photographic figures might give one the impression that the projection of the lunule into the valve cavity stands free from the valve below it. This is not the case, as it forms a little buttress, with slightly spreading base, lost in shadow in the photograph. The type is a left valve, fig. 10, but a paratypic right valve is mounted with it in the collection. No entire specimen was found.

NEW PERUVIAN LAND MOLLUSKS

By H. A. PILSBRY

The collections of Dr. W. Weyrauch, of Lima, Peru, submitted to me for study, contain many interesting land shells, a considerable number being new to science. A paper describing these will soon appear; meantime I select two which have been named in his honor, for illustration in Nautilus.

Bostryx weyrauchi, n. sp. Plate 9, fig. 5.

Shell having the general appearance of *B. eremothauma* Pils. being wider than high, acutely carinate and openly umbilicate; opaque, nearly white, with four indistinct spiral bands of pinkish-cinnamon on the base and some faint streaks above. Surface matt, with rather fine, uneven sculpture of strongly retractive

wrinkles on the upper surface, the base with some low axial ridges and traces of a few impressed spirals. Whorls 5½, the first two whorls convex, projecting as an apical mucro, smooth and white. Following whorls flattened, concave above the peripheral keel, which projects above the suture on the penult whorl. Lower surface concave below the keel, then sloping to a strong keel around the broad, funnel-shaped umbilicus. The suture descends rather deeply in front. Aperture semicircular, cinnamon colored within, the peristome paler, expanded, somewhat angular at the termination of the peripheral angle, the margins approaching rather closely. Height 17.8 mm., diameter 20 mm.

Ninabamba, near Ayacucho, Peru, at 2000 meters elevation. Type 179979 ANSP.

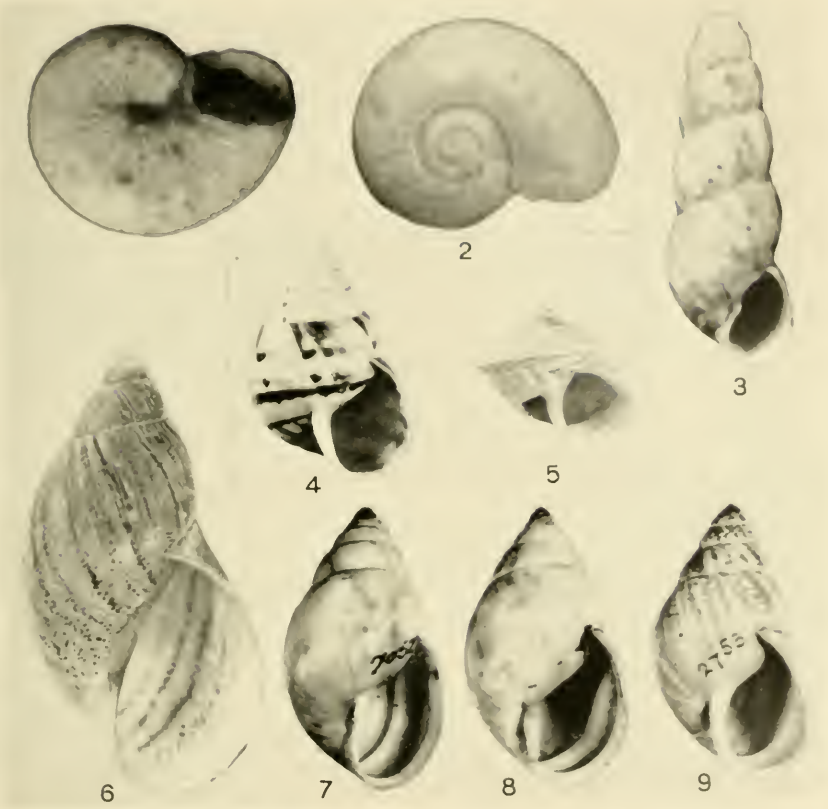
This is a second member of the subgenus *Platybostryx*. It is larger than *B. eremothauma* with more elevated spire, narrower umbilicus and less angular outer lip. The color markings described are rather faint. Named in honor of Dr. W. Weyrauch.

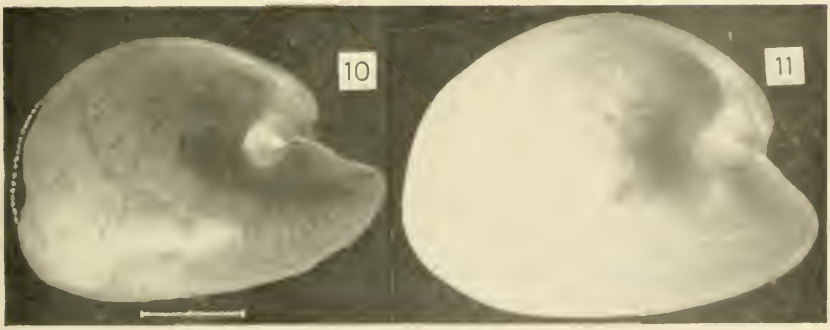
Neopetraeus weyrauchi, n. sp. Plate 9, fig. 4.

The shell is acutely and broadly ovate with an umbilicus narrow within but becoming very wide by deviation of the last half whorl. Rather solid though not thick. Pale pinkish buff, with chestnut-brown markings in form of three spiral series of spots on the penult whorl, and on the last a subsutural irregular series of streaks, a band of small spots at periphery and another in middle of upper surface; immediately below periphery a continuous nearly black band, with a narrower one in the middle of the base, the space below it streaked with chestnut-brown. Whorls 6⅓, the apex somewhat mucronate, with *Neopetraeus* sculpture typical in pattern but extremely weak; following whorls nearly flat, with rather weak, uneven, wrinkle striation. Suture hardly impressed, ascending to the lip. Aperture oval, pinkish vinaceous and showing the bands within. Peristome thin, whitish, the outer and basal margins very little expanded, columellar margin dilated forward. Length 28.5 mm., diameter 20 mm., length of aperture 16 mm.

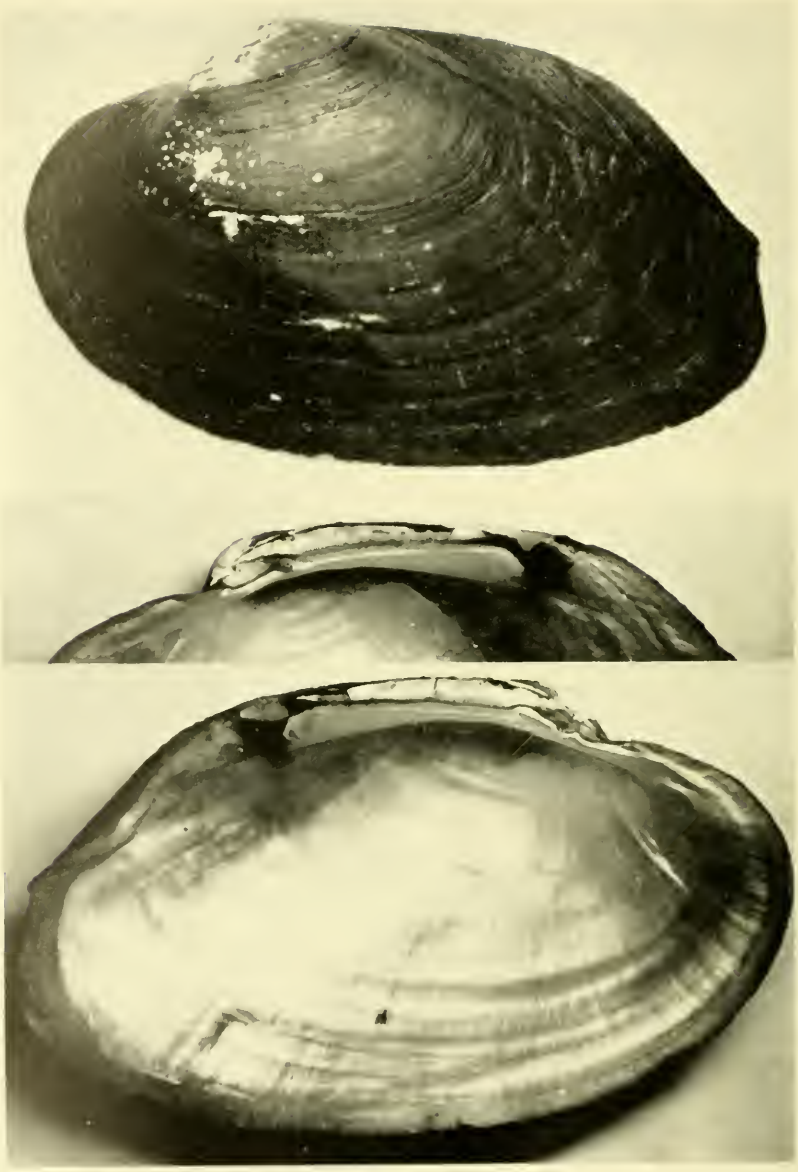
Huaraz, Santa Valley, Peru, at 3200 meters. Type 179980 ANSP.

Near *N. atahualpa* (Dohrn), but it differs by having the suture not at all impressed, being filled by the keel of the whorls, which continues nearly to the last whorl. The outlines near the summit are more concave, becoming convex on the last two whorls. *N. tessellatus* (Shuttl.) has a more straightly conic spire.





1, 2, *Vitrinella blakei.*
3, *Orinella vanhyningi.*
4, *Neopetraeus weyrauchi.*
5, *Bostryx weyrauchi.*
6, *Plekocheilus weyrauchi* Pilsbry.
7, *Bulimulus d. mooreanus.*
8, *Bulimulus d. schiedeanus.*
9, *Bulimulus d. liquabilis.*
10, 11, *Julia equatorialis* (scale line = 1 mm.).



Fossula venezuelensis.

A VENEZUELAN SPECIES OF *FOSSULA*

By H. A. PILSBRY and A. A. OLSSON

Fossula has hitherto been known by several species from south of the Amazon. The species here described was found in the Rio Guarico at Barbacoas, State of Guarico, Venezuela (Olsson, March 1941). It is, we believe, the first from northern South America.

Fossula venezuelensis, n. sp. Plate 10.

The shell is oblong, the height 58 percent of the length, moderately inflated, of medium weight. It gapes slightly from the middle of the ventral margin to the anterior end, and somewhat less along the posterior-dorsal slope. Beaks moderately prominent, at about the anterior fourth of the length. Dorsal and ventral margins but slightly curved, roughly parallel. Anterior end narrower, rounded. Posterior end oblique, having a projecting point at the end of a low, black ridge running from the beaks. Epidermis yellowish olive, much darker towards the ends. The interior is silvery and iridescent, with a rather wide dull prismatic border, widest (5.3 mm.) near and at the posterior end. Cavity of the beaks deep. Anterior muscle impression distinct, the posterior ill defined.

In the right valve there is an erect, elongate anterior cardinal tooth (not well shown in the plate, as it did not catch the light, and is represented by a dark area anterior to the rim below the pit, which shows white in the photograph). The pit below the beak is large (light in the photograph), and there is no tooth posterior to it. The left valve has an erect, rather long irregular tooth below the beak. In place of lateral teeth there is a broad convex hinge plate, terminated by a nearly black triangular sinulus.

Length 98 mm., height 57.5 mm., diameter 33 mm.

Type 179759 ANSP. The arrangement of the low "teeth" is substantially as in *F. fossiculifera*, the type of *Fossula*, but they are longer. The pit below the beak in the right valve is longer, and it is bounded below by a more prominent callous ridge. The prismatic internal border of the valves is not so wide as in *fossiculifera* compared. But the most conspicuous difference from the four forms described from south of the Amazon is the much lower, oblong or elliptical rather than subtriangular outline.

OBSERVATIONS ON *PSEUDOMONOTIS*, A LATE PALEOZOIC PELECYPOD

By DAVID NICOL

Stanford University, California

While the writer was collecting data on the validity of reports of Paleozoic Ostreidae, he found that the question of the time of origin of shell attachment in pleurothetic pelecypods was important. Especially for this latter problem, it was necessary to study the genus *Pseudomonotis*,[1] a member of the Paleozoic Pectinacea.

The writer wishes to express his appreciation to Dr. Norman D. Newell of the University of Wisconsin for his interest and helpful suggestions on this subject.

The earliest pelecypods are equivalve free living types. Byssal attachment also is found in many ancient pelecypods, but some of the other adaptations to various kinds of environment appear much later. One of the latter is the oyster-like habit of having one valve cemented to the substrate. This adaptation has originated independently many times in various pelecypod stocks and is common from the Mesozoic to the Recent. Occurrences in the Paleozoic are apparently meager.

There is infrequent mention in the description of Paleozoic pelecypods about the occurrence of shell fixation by cementation. Jackson (1890, pp. 325, 326) points out that the earliest oyster is one described by Barrande (1881, pp. 233, 234) as *Pracostrea bohemica* from the Upper Silurian. In the description of this species Barrande does not refer to attachment of either valve or to an attachment scar, although fig. 4 of plate 111 may show either that there is an attachment scar or that the umbo of the specimen is broken. This is apparently the only reference to a Pre-Carboniferous oyster. In a few scattered monographs, most of which were written before 1900, a few poorly preserved specimens have been described as members of the family Ostreidae.

According to Newell (personal communication) these specimens of so-called *Ostrea* from the Pennsylvanian and Permian

[1] *Pseudomonotis* is here used in the same generic sense as Newell (1938, p. 92) applied it, genotype *Gryphites speluncarius* Schlotheim, by subsequent designation.

can probably all be allocated to the genus *Pseudomonotis.* A careful check of descriptions and figures has led the writer to the same conclusion. *Pseudomonotis,* unlike the oyster, was attached by the right valve and not by the left one. Morphologically the genus comprises a large and heterogeneous group which, because of its attached habit, showed a reduction of the ears and assumed the form of an oyster. Some species are gryphaeoid in form while others have typically flat valves and show a pronounced attachment scar. *Pseudomonotis hawni,* as figured by Newell (1938, pl. 17, figs. 8, 11a), clearly shows the scar of fixation.

Newell (personal communication) believes that *Pseudomonotis* may have had a method of attachment like *Anomia* because in many forms the byssal notch seems to have been so overgrown at the periphery that it was in effect a perforation. The irregular growth of the adult specimens during later life and the fact that some Pennsylvanian species show the transfer of surface ornamentation of the host to which the shell was attached has convinced Newell that *Pseudomonotis* was fixed by its shell. On the other hand specimens of *Pseudomonotis speluncaria* in the paleontology collection at Stanford University show no signs of attachment. Large, flat, oyster-like specimens from the Gamma member of the Kaibab formation of Arizona clearly indicate that they were attached during the adult stage.

Pseudomonotis, which has a geologic time range from Pennsylvanian through Permian, is the only Paleozoic pelecypod definitely proved to have acquired shell fixation. From Triassic onward the occurrence of this adaptive habit appears widespread among this class of molluses.

Why this adaptation was not more common and did not occur early in the Paleozoic is not known. Certainly the number of genera and species of Paleozoic pelecypods is great. Perhaps the best explanation for the scarcity of this modification is given by Dacqué (1921, p. 296) who states that the brachiopods were the dominant group of animals in the same type of environment in the Paleozoic that the pelecypods occupied from the Mesozoic to the Recent. Many brachiopods during the Paleozoic attached themselves to the hard substrate by shell fixation. With the rapid disappearance of numerous brachiopod genera at the end

of Permian time, and their continued decrease in numbers throughout the Mesozoic, the similarly adapted pelecypods could take over the environmental niches left by the brachiopods. Adaptive radiation in the pelecypods has been developed to its fullest extent from Mesozoic time onward.

As a resumé the following conclusions can be presented:

1. Members of the family Ostreidae do not appear in the Paleozoic Era, and species described in this family belong to the genus *Pseudomonotis,* a member of the superfamily Pectinacea.

2. Fixation to the hard substrate with the accompanying modifications of shell morphology have so far definitely been proved to occur only in *Pseudomonotis* which has a geologic time range from Pennsylvanian through Permian. Further investigation may find other examples of this adaptation and even earlier cases of it than are recorded here. However, these additional cases will not alter the fact that shell fixation by cementation in pelecypods occurs rarely in the Paleozoic Era.

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THE *SPHAERIIDAE,* A PRELIMINARY SURVEY

By STANLEY TRUMAN BROOKS and H. B. HERRINGTON

Although Temple Prime, Dr. Victor Sterki and others have paid much attention to the taxonomy of the *Sphaeriidae,* that group is in a chaotic state. Identifications are difficult or impossible.

Not only have the present students found the *Sphaeriidae* to be an exasperating portion of our fauna but, also, Dr. Sterki has long put his complaints into writing. Writing to Chief Justice Latchford, Sterki made the following comment, "It is hardly necessary to offer you excuse or explanation for doubtfully identified forms, as in the list; you certainly understand that "species" are not always "clear cases." Some of our *Sphaeriidae* are so perplexingly variable that it is impossible, at present, to outline them, or more practically, to know whether a given "form" is inside or outside that limit. One of the most difficult is e.g., *Sphaerium striatinum,* with apparently no end of variation, or varieties and local forms; similar cases are those of *M. securis, rosaceum, truncatum,* and a number of *Pisidia.*" Nineteen years later (January 10, 1930), writing to the same individual as he returns material he has been examining, Dr. Sterki writes in the same vein: "Most of the spp. are very variable and some are very difficult to define and confine, e.g. *striatinum, stamineum,* even *solidulum.*" And these statements can be duplicated many times from Sterki's notes in the Carnegie Museum.

A comprehensive programme of research should include:

1 (a) A re-study of all shell characters, especially hinge teeth, general shape, the young, etc., of both recent and fossil forms.

(b) Comparison with the original descriptions.

2 Preparation of clear descriptions and good figures of each species.

3 Anatomical investigations.

As a first step in this direction these preliminary remarks are offered.

The authors have been gathering data about the larger eastern forms of the family *Sphaeriidae* (genera *Sphaerium, Musculium*), and have found the following principles involved:

1. That the myriad forms hitherto placed under the genera *Sphaerium* and *Musculium* are generalized groups and/or, in some cases, species which are even today still undergoing evolutionary development. The generalized forms are exactly represented by the groups *Sphaerium sulcatum* and *Sphaerium striatinum,* both of which form a complex evolutionary structure of interrelated (ecological and geographical) units.

2. That the genus (so called) *Musculium* is in reality a division of the genus *Sphaerium,* and cannot be separated, on the basis of conchological characters, from that genus. In this statement we are in harmony with older American and European opinion. The calyculae of the shells are not a character of generic standing. It is noted, however, that in this genus a further speciation has taken place than within the genus *Sphaerium* (in the strict sense).

3. That the species *Sphaerium rhomboideum, Sphaerium walkeri, Sphaerium occidentale,* and *Sphaerium corneum* form a separate group belonging together. These have been included by Dr. Victor Sterki in the "*corneum* group." They impress one as a group of true species rather than as a species with variations. They are all loosely linked together by the embryonic forms, however.

4. That the *sulcatum* complex is distinguished by the uniform striae and the shape and large size of the embryonic specimens. In all these species (so called) the similarity of the very young and unborn shells is a striking feature. One can trace the development of these into the various described kinds, but funda-

mentally they form (the embryos) one group. The following are forms of *sulcatum:*

S. sulcatum Lam.
" " *insigne* St.
" " *albescense* St.
" " *fallax* St.
" " *dakotense* St.
" " *obscurum* St.

S. sulcatum planatum St.
" " *decisum* St.
" " *lineatum* St.
" " *crassum* St.
" " *ellipticum* St.
" " *sculptum* St.

5. That *Sphaerium striatinum* (as a group) is distinguishable from the others by the more widely spaced striae (when striae are present, specimens may be smooth or heavily striated), and by the shape of the embryos; i.e., although the texture of the shell is the same in *sulcatum* and *striatinum,* if you take an embryo of the same size from each of these the dorsal margin of the *sulcatum* will be straight, that of *striatinum* will be somewhat bent downward in front of the beak. This make *striatinum* less equilateral in shape. Even though one can see the first steps toward speciation within this group the indefinite limits of variation are not sufficiently stable to constitute ascertainable species. The following are forms of *striatinum:*

S. striatinum Lam.
" " *corpulentum* St.
" " *modestum* St.
" " *badium* St.
" " *rugosum* St.
" " *solidum* St.
" " *decorum* St.
" " *novangliae* St.
" " *tenerum* St.
" " *attenuatum* St.
" " *levissimum* St.
S. stamineum Conrad
" " *forbesi* St.
" " *laeve* ?
S. notatum St.
" " *gibbosum* St.
" " *glabrum* St.
S. acuminatum Prime
" " *diaphanum* St.
" " *lacuum* St.
S. cumberlandicum St.
S. nylanderi St.
S. eminens St.

S. lilycashense Baker
S. wrighti St.
S. solidulum Prime
S. canadense St.
S. bakeri St.
S. torsum St.
S. emarginatum Prime
S. wisconsinense St.
S. altile St.
S. pilsbryanum St.
S. hendersoni St.
S. declive St.
S. obtusum St.
S. browni St.
S. concinnum St.
S. elegans St.
S. vermontanum Prime
S. ornatum St.
S. regulare St.
S. cerinum St.
S. redense St.
S. laevigatum St.
S. ohioense St.

6. That the *Musculia* (*Musculium*) stand close to the *corneum* group. The fine texture of the shell is much the same, and very unlike that of *sulcatum* or *striatinum* which is coarser. Most of the *Musculia* are also markedly more fragile than the *Sphaeria*. But the tougher forms are as rugged as *Sphaerium walkeri* St. When one studies the entire group, neither by means of adult characters nor young specimens can one determine where one "species" leaves off and another begins (within this "genus"). Mr. Herrington has found that by taking the extreme forms of *Musculia* and placing them along with the less extreme that they "fit together like the pieces of a puzzle." One might say that this group is on the verge of speciation but still retains too many of the general characteristics to be divided successfully now.

The Pittsburgh member of this present survey feels that perhaps we have been too greatly overshadowed by the complex in our comprehension of the *Sphaeriidae*. Perhaps it is simply a case of great simplicity—a few groups widely dispersed and extremely variable. At any rate this represents our present outlook. We are seeing some light—the more light as we see more and more relationships within the mass of specimens. Each major group is found to have a pattern of distribution and a pattern of anatomical features which will undoubtedly lead to the proper vision of this vast complex of animal life.

To assist us in this work we are asking fellow conchologists to make an especial effort at collecting both Pleistocene and recent material. The Pleistocene picture we hope will be the secret door to the apparent present day complexity of the group. There, we hope, will our simplification be more strongly illustrated—the pattern more broadly illuminated. Today, and with the specimens of today's evolution we are laboring under a burdensome mass of observation and speculation freighted with misconceptions and fallacies.

We ask that each collector will please give data—date, elevations, flood condition, watershed, lake, or stream, etc., with specimens sent in.

It may be interesting to others to know that the Carnegie Museum is keeping the Sterki Collection intact under the names Sterki used. Only a small portion has been removed and renovated for this study. We still need collections from many areas

and especially from the Pleistocene. Wherever the older (and some of the present) collectors live or have lived, that area is usually well represented in our cabinet. The newer students of mollusks can greatly extend our range of material into newer fields.

Specimens may be sent to Dr. Stanley Truman Brooks, Carnegie Museum, Pittsburgh, Pa., or to the Rev. H. B. Herrington, Newburgh, Ont., Canada.

A NEW *VITRINELLA* FROM MARYLAND [1]

By HARALD A. REHDER

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United States National Museum

Among the numerous mollusks that Dr. S. F. Blake has found in his researches on the Pleistocene fauna of Maryland is this small *Vitrinella* that seems to be undescribed, and which I am pleased to name for the discoverer.

VITRINELLA BLAKEI, new species. Plate 9, Figures 1, 2.

Shell very small, depressed-helicoid, with a low spire, opaque white. The last whorl is large, strongly convex, and sculptured on the upper surface by well-defined, short, axial wrinkles of varying length, running down from the suture, and stronger, more crowded ones around the deep narrow umbilicus; there are likewise numerous fine spiral grooves in the peripheral region. Aperture suborbicular, flattened somewhat in the columellar portion and bluntly angled at the base thereof.

The type, U.S.N.M. No. 537834, measures: Height, 0.7 mm.; greatest diameter, 1.2 mm.

It was collected in Bed 1 (lowest bed) of the Talbot formation of the Pleistocene at Wailes Bluff, near Cornfield Harbor, at the southern tip of St. Mary's County, Maryland.

The axial wrinkles in the umbilical and sutural region, and the narrow umbilicus, will distinguish this species from other West Atlantic forms. It will very likely be found to be also living along our coast.

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[1] Published by permission of the Secretary of the Smithsonian Institution.

THE "APERTURAL RIDGE" IN *BULIMULUS*

By GORDON K. MacMILLAN

Carnegie Museum

Many species of the genus *Bulimulus* in the southern section of the United States are characterized by the presence of a ridge on the lower portion of the aperture. This ridge, which I have designated as the "apertural ridge," varies greatly in thickness and is usually present close to the peristome, about ⅓ the distance within the aperture, or so far back as to be nearly hidden by the parietal wall. There are a few specimens in which there are two of these ridges very close together, but in the majority of the specimens there is present only one ridge. Specimens with such ridges are illustrated in Plate 9, figures 7, 8, 9.

The presence of these "apertural ridges" might indicate a resting stage in the life of the snail, much as the varices of some of the larger snails of the family *Orthalicidae*. The thickness of the ridge probably indicates a longer or shorter period of estivation. In those specimens in which there is an absence of the ridge, it might have been absorbed by the animal as it continued to grow and enlarge its shell. For some reason, during the subsequent growth of the animal, many of these ridges were not absorbed and are thus present on the apertural floor.

The "apertural ridge" has been observed in the following snails:

Bulimulus dealbatus dealbatus (Say)
Bulimulus dealbatus ragsdalei (Pilsbry)
Bulimulus dealbatus patriarchus (W.G.B.)
Bulimulus dealbatus schiedeanus (Pfr.). Fig. 8.
Bulimulus dealbatus mooreanus (W.G.B.). Fig. 7.
Bulimulus dealbatus liquabilis (Reeve). Fig. 9.
Bulimulus dealbatus ozarkensis Pils. & Ferr.
Bulimulus alternatus mariae (Albers)
Bulimulus alternatus alternatus (Say)

There are only a few references in molluscan literature which mention the existence of the "apertural ridge" in any of the species of *Bulimulus*. W. G. Binney on page 127 in a Supplement to the Terrestrial Air-Breathing Mollusks of the United States and Adjacent Territories of North America, 4, 1859, men-

tions in the description of *Bulimulus alternatus* Say that the "labrum (in some species) with a thickened line or rib on the inner submargin." This is repeated in the Land and Fresh Water Shells of North America, part 1, 1869, on page 200 and in A Manual of American Land Shells, 1885, on page 396. On pages 200 and 397 respectively of the latter two publications are the following remarks concerning this species, "The aperture, however, is always dark, and has a white, thickened rim within the peristome," and "This species is readily distinguishable from the allied forms by . . . its dark-colored aperture, bordered within with the white internal margin of the aperture. The aperture, however, is always dark, and has a white, thickened rim within the peristome."

The description of *B. dealbatus mooreanus* (W.G.B.) in the Land and Fresh Water Shells of North America, part 1, is found on page 200. Part of this includes the following notation, "peristome . . . , with an internal delicate white rim." This is repeated by Binney in A Manual of North American Land Shells on page 400.

In Biologia Centrali-Americana, Land and Freshwater Mollusca, 1893, on page 244, Eduard von Martens, after having examined a number of specimens of *"B. mariae"* from Texas in German collections, endorses W. G. Binney's remarks concerning *Bulimulus alternatus* and quotes part of it as follows, "This species is readily distinguishable from the allied forms by . . . its dark-colored aperture, with the white internal margin of the peritreme." von Martens also says that "the thickened white line or rib on the inner submargin" agrees well with our species of *Bulimulus alternatus*.

Dr. H. A. Pilsbry, Manual of Conchology, 11, 1897, 129, mentions that the "peristome acute, . . . or with a rib within" of *Bulimulus* (*Orthotomium*) *dealbatus* (Say).

Among the large list of mollusca collected in the southwestern States were specimens of *Bulimulus dealbatus liquabilis* (Reeve) and *B. d. ragsdalei* (Pilsbry). These are listed in the "Mollusca of the Southwestern States, II," in the Proceedings of the Academy of Natural Sciences of Philadelphia, 58, 1906, 135 & 137. Of the former, Pilsbry and Ferriss state that the shells of Lee Co., Texas, has a "lip-rib present in adults" and in the latter the "lip-rib strongly developed."

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VARIATIONS OF *SPISSULA SOLIDISSIMA* DILLWYN

By MORRIS K. JACOBSON

The species that is the subject of this paper manifests certain pronounced variations. Verrill in 1872 noted (Report upon the Inv. Animals of Vineyard Sound, p. 358): ". . . there is great variation in the form of the shell, some being oval, others more oblong or elliptical, and others nearly triangular; some are swollen, others quite compressed, but all the intermediate grades occur." This observation can be made by anyone who examines even cursorily a series of mature shells. It might be of interest to have these variations mathematically expressed. The chief variations may be defined as follows: the degree of ovalness (the ratio of height to length); the degree of inequilateralness (the distance of the umbo from the center); the askewness (the angle formed by the greater and lesser diameters); and the obesity. This paper will discuss the first three, leaving the last for a subsequent essay.

This species is easily the most prominent molluscan feature of our east coast ocean beaches. Though in actual numbers it may be second to *Mytilus edulis* Linne, the latter is not so noticeable because of its much smaller size and definite localization on rocks, jetties and posts. *Spissula* is occasionally thrown upon our beaches in incredible numbers. Arthur Jacot (Naut. 34: 59f) estimated, after a violent winter storm, that no less than 5,000,000 animals to the mile had been cast up along a beach that extends five miles in either direction. Almost every winter, when severe storms undercut large reefs, our beaches are literally piled high with live bivalves, where, preserved by the natural refrigeration of winter, they provide a lasting feast for the gulls.

The shells represented in this study were collected at random on the beach at Rockaway, New York, care being taken however to reject valves too badly eroded or broken, and to limit the selection to shells of medium or large size. The shells studied varied in length from 182 mm. to 103.5 mm., the average size being 136.1 mm. Although no attempt was made to select right or left valves (actually there happened to be 54 left valves and 46 right), in no case were both valves of the same animal chosen.

Abnormal shells, shells that had been severely broken and subsequently repaired by the animal, where this repair work altered the outlines, or where damage to the mantle resulted in abnormal development of the ventral margin (cf. R. T. Jackson *Phylogeny of the Pelecypoda,* quoted by Chas. B. Davenport, *Am. Nat.* XXXIV, No. 407, p. 871)—such shells were discarded. However it must be understood that few if any of the shells examined were perfect, since the grinding action of wave and sand on such an exposed beach as Rockaway resulted in pronounced if unimportant imperfections. Thus in almost all cases the periostracum was largely or entirely removed, the ventral margin more or less severely chipped and the posterior shell structure surrounding the siphon—this being the area most frequently exposed to the action of the elements—was much battered, eroded and thickened. In some cases the interior of the shell disclosed an encysted mass of sand, which had probably been forcibly driven into the area between the mantle and the interior shell wall and had there been covered over with shell matter. One shell found (not included in this study) had its capacity reduced by as much as 20% (estimated) by such a sand cyst.

The tables given below will indicate mathematically the fact and extent of structural variation in the species. In most cases the tables need no explanation with the exception perhaps of the first. Here the clumsy term "umbo/length ratio" is used. By this is meant the ratio between the greater diameter (the length) and the distance of the umbo from the center of this line. To arrive at this figure the diameter is drawn and to it is dropped a perpendicular from the umbo. The distance from the point of contact to the center of the diameter is then measured and the ratio easily arrived at. If the umbo were perpendicularly above the center, the ratio would be zero. Hence a ratio of .163 shows a considerable degree of inequilateralness. The smallest ratio was found to be .030. The actual measurements of this distance varied from 28.5 mm. on a diameter of 182 mm. to 4 mm. on a diameter of 132 mm.

Ecologically the findings are without significance, since habitat data of all specimens studied are substantially identical. Nor, as table IV shows, is there any correlation between the two ratios discussed; thus a shell with the height/length ratio of .744 might

have an umbo/length ratio of anywhere between .037 and .157. Similarly an umbo/length ratio of .094 might have its corresponding height/length between .655 and .833. The findings, then, as far as the deduction of formulae or rules is concerned, are completely negative, and the author leaves in the hands of competent biologists and paleontologists the determination of the morphological significance of the variations studied.

The kind interest and advice of Dr. William A. Clench of Harvard is acknowledged, and thanks expressed to Mr. Randolph Gunthert of John Adams High School, New York and Miss Frieda Rosenfeld of Hunter College for aid in the mathematical and statistical aspects of the paper.

Table I

The first column expresses the umbo/length ratios, the second the number of shells for each ratio.

Ratio from			
.030–.034	2	.100–.104	6
.035–.039	3	.105–.109	3
.040–.044	3	.110–.114	7
.045–.049	1	.115–.119	2
.050–.054	7	.120–.124	1
.055–.059	1	.125–.129	2
.060–.064	1	.130–.134	5
.065–.069	5	.135–.139	2
.070–.074	5	.140–.144	3
.075–.079	7	.145–.149	3
.080–.084	5	.150–.154	0
.085–.089	4	.155–.159	2
.090–.094	5	.160–.164	1
.095–.099	13	.165–.169	1
		Total	100

The mean is .093, the standard deviation .032.

TABLE II

The first column represents the height/length ratios.

.650–.654	1	.750–.754	5
.655–.659	1	.755–.759	3
.660–.664	0	.760–.764	6
.665–.669	1	.765–.769	5
.670–.674	0	.770–.774	6
.675–.679	2	.775–.779	2
.680–.684	1	.780–.784	0
.685–.689	2	.785–.789	0
.690–.694	2	.790–.794	1
.695–.699	4	.795–.799	0
.700–.704	1	.800–.804	0
.705–.709	2	.805–.809	1
.710–.714	10	.810–.814	0
.715–.719	7	.815–.819	3
.720–.724	4	.820–.824	1
.725–.729	6	.825–.829	0
.730–.734	3	.830–.834	1
.735–.739	5		—
.740–.744	6	Total	100
.745–.749	8		

The mean is .737, the standard deviation .035.

TABLE III

In this table are represented the variations in the angle formed by the intersection of the greater and lesser diameters, i.e. the askewness of the shells.

Degrees	Shells	Degrees	Shells
90–94	7	105–109	23
95–99	27	110–114	6
100–104	37		—
		Total	100

TABLE IV

This table represents the correlation between the ratios of Table I and Table II.

Height/length ratios	Actual umbo/length ratios	Total shells
.650–.654	.102	1
.655–.659	.094	1
*.665–.669	.063	1
*.675–.679	.071, .079	2
.680–.684	.065	1
.685–.689	.079, .097	2
.690–.694	.119, .132	2
.695–.699	.042, .071, .078, .130	4
.700–.704	.068	1
.705–.709	.098, .108	2
.710–.714	.054, .053, .083, .094, .096, .100, .103, .101, .131, .163	10
.715–.719	.030, .058, .075, .083, .100, .114, .155	7
.720–.724	.044, .094, .097, .144	4
.725–.729	.030, .077, .097 (2), .114, .132	6
.730–.734	.038, .098, .112	3
.735–.739	.070 (2), .087, .092, .113	5
.740–.744	.037, .051, .053, .096, .116, .157	6
.749–.749	.044, .050, .065, .086, .089, .104, .113, .139	8
.750–.754	.082 (2), .099, .105, .148	5
.755–.759	.071, .097, .127	3
.760–.764	.052, .066, .076, .098, .109, .110	6
.765–.769	.035, .052, .120, .127, .146	5
.770–.774	.078, .081, .097, .114, .138, .144	6
.775–.779	.132, .144	2
*.790–.794	.147	1
*.805–.809	.049	1
*.815–.819	.069, .089, .160	3
.820–.824	.096	1
*.830–.834	.094	1
		100

* H/l ratios, not represented by corresponding u/l ratios, are omitted.

NOTES AND NEWS

THE DESERT MUSEUM at Palm Springs, Calif., which was closed for the summer on May 15, was opened on October 16. In the absence of the Curator, Professor and Mrs. T. D. A. Cockerell have taken charge of the museum.

DR. HENRY VAN DER SCHALIE, assistant curator of mollusks at the museum of zoology of the University of Michigan, has been awarded the Walker Prize of the Boston Society of Natural History. The value of the prize was increased this year from $50 to $100 in recognition of the excellence of Dr. van der Schalie's work on "The Value of Mussel Distribution in the Tracing of Stream Confluence."—*Science*, Dec. 3.

AFTER fifty years of academic service Dr. Henry E. Crampton has retired with the title of emeritus professor of zoology of Columbia University. The authorities of the American Museum of Natural History have provided him with facilities to continue his researches on the distribution, variation, evolution and heredity of gasteropod mollusca, especially in Partula and in Lymnaea. Dr. Crampton has made several expeditions to the South Seas for the collection of series of individuals of the species of Partula, having about 250,000 individuals of that genus. Three volumes of the results of his work have appeared, and the material for still others is undergoing preparation.—*Science*, Oct. 14, 1943.

OTALA VERMICULATA Müller AND O. LACTEA Müller IN TEXAS—Among some land shells collected at Bryan, Brazos County, Texas and submitted by Mrs. Laura Sebesta for determination, I was surprised to note the occurrence of *Otala vermiculata* and *O. lactea*. Subsequent inquiry elicited the information that this colony was started seventeen years ago when an Italian merchant bought two bushels of snails from New York for his retail trade. After selling a portion, the remainder were dumped behind his store, assuming they were dead. Evidently some were alive as a colony of both species exists as attested by living examples submitted.—RALPH W. JACKSON.

A NEW SUBSPECIES OF *Conus verrucosus* Hwass FROM FLORIDA [1]—Some time ago Dr. T. Van Hyning sent to the National Mu-

[1] Published by permission of the Secretary of the Smithsonian Institution.

seum some specimens of a *Conus* from Florida that undoubtedly is close to *Conus verrucosus*, but deserves a distinct subspecific designation. In honor of the indefatigable student of Florida malacology, to whom we owe this striking form, I am calling it:

Conus verrucosus vanhyningi, new subspecies. It resembles *verrucosus* but has a ground color of a distinct pinkish tint, with the interior of the outer lip similarly colored near the edge, becoming orange-brown deeper within the aperture. In the typical form the aperture is white within. The type, U.S.N.M. No. 537863, measures: Height, 17 mm.; diameter, 10.4 mm. It and four paratypes were collected by W. A. Royce on a beach off Pompano, Broward County, Florida.—H. A. Rehder.

Smaragdia viridis viridemaris Maury.—On December 31, 1940, Dr. Henry D. Russell published "Some New Neritidae from the West Indies," wherein he proposed calling the European green nerite, *Smaragdia viridis* Linné, and giving the West Indian form the new subspecific name of *S. v. weyssei*. In his description he does not include the white form, and remarks that only 3 to 15 per cent of the specimens from any one lot have the brownish-red broken lines.

In the recent dredgings of T. L. McGinty in fms. off Palm Beach, Florida, were found several *Smaragdia*, pure white, with milky zigzag maculations, these in part outlined with double, thread-like, dark brown, broken lines. Dr. Henry A. Pilsbry states (Proc. Acad. Nat. Sci., 1921, p. 396) that the zigzag stripes are quite prevalent on specimens from the Gabb collection, Santo Domingo Miocene, giving them more the appearance of the European species.

There being no subspecific name for the recent West Indian specimens of *Smaragdia* with the broken lines, we would propose to call them *S. v. viridemaris* Maury (1917), used by Woodring for the Santo Domingo and Jamaican Miocene form, either green or white, which has the zigzag, brownish lines.—Jeanne S. Schwengel.

Orinella vanhyningi, new species. Plate 9, Figure 3. Shell minute, cylindro-conic, pale horn colored with irregular axial white markings that give to the surface a watered-silk effect. Nucleus deeply immersed in the first postnuclear whorl which

lends to the shell a truncated aspect. Postnuclear whorls rather high between summit and suture, marked by irregular incremental lines which somewhat simulate axial ribs. Suture very deeply constricted. Periphery well rounded. Base somewhat inflated, well rounded, narrowly umbilicated. Aperture rather large, ovate; outer lip thin, evenly curved; inner lip rendered sigmoid by the strong folds at the insertion of the columella.

The type, U.S.N.M. No. 346650, was collected by T. Van Hyning in Big Bayou, St. Petersburg, Florida. It has 5 postnuclear whorls and measures: Height, 2.3 mm.; greater diameter, .8. U.S.N.M. No. 346651 contains 4 topotypes from the same source, and 17 more are in Mr. Van Hyning's collection.—Paul Bartsch.

Taranini.—In attempting a supergeneric classification of the family Turridae, using soft parts, radula and shell for expressing relationship, the disposition of Casey's tribe Taranini (1904. Transactions of the Academy of Sciences of St. Louis, volume 14, pages 168–169) has come up for consideration.

The type genus *Taranis* Jeffreys (1870. Annals and Magazine of Natural History, series 4, volume 5, page 447) has for the type *Taranis mörchi* Malm. A re-examination of the animal of this species enables us to agree with Krause's statement (1887. Beitrag zur marinen Fauna des Nordlichen Norwegen, page 20) that the operculum and radula are absent and that the siphon is moderately long and the single feather-like gill has the filaments on one side. To this may be added that very small eyes are present and situated not on the tentacles as is usually the case in Turrids, but slightly on each side of the median line between them. There is no pronounced posterior sinus. Casey evidently mistook the median keel for it. The nuclear whorls bear numerous fine spiral threads and incremental lines which give the spaces between them a somewhat pitted appearance.

In summing up all of these characters, I am led to believe that this genus is not Turrid. I am equally undecided where else to place it. It seems possible that Casey's tribal name Taranini may have to be changed to Taranidae.

Nuclear characters exclude the West Atlantic species referred here by Verrill and Dall. The *Raphitoma amoena* Sars listed as *Taranis amoena* by subsequent authors, while it resembles *Taranis,* bears no relationship to it. Radula and the rest of the characters are Turrid.—Paul Bartsch.

Hemphill's Catalogue of the Land and Freshwater Shells of Utah.—This title appears on a small 16 mo. leaflet published in Oakland, California in 1878 by Henry Hemphill. This must be a rare publication. It is not quoted at all in the bibliography of Chamberlin and Jones—A Descriptive Catalog of the Mollusca of Utah (Bull. Univ. of Utah, 19, no. 4, pp. 10 + 203, 1929). Again, it is not quoted in Pilsbry's Land Mollusca of North America (Monographs Acad. Nat. Sci. Philadelphia no. 3, 1, pt. 1, 1939), where the names are credited to Binney or "Hemphill" Binney under the date of 1886.

Though the title covers the State of Utah, the brief introduction states "this remarkable series of land shells, collected by me during last summer and fall in the canyons of the Wassatch Mts., Utah." The list of 26 species of freshwater shells, however, would indicate that these, at least, were obtained in territory beyond the limits of the Wahsatch Mountains. [Wassatch and Wasatch are alternate spellings.] Hemphill has included the Oquirrh range as part of the Wassatch Mountains and Utah Lake is in the basin between these two mountain chains. Many of the freshwater shells were obtained from this lake.

The few descriptive remarks hardly constitute "description" of the few names first introduced in this list, all in the genus "Patula" [Oreohelix]. However, the terms do cover briefly the varieties in question and are certainly equal in value to a host of names that have been employed by many of his contemporaries, and now accepted as valid.—William J. Clench.

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NOTES ON LAND SLUGS OF LOS ANGELES AND ORANGE COUNTIES, CALIFORNIA

By WENDELL O. GREGG

Though during the past 23 years much collecting of non-marine mollusks has been done by the writer in this area, it has been only during the past three years that a particular effort has been made to study the local land slugs. Our present knowledge of this group as represented in Los Angeles and Orange Counties, California, includes eight species. Of these, six species belong to the family Limacidae. Two species, *Anadenulus cockerelli* (Hemphill) and *Hesperarion hemphilli* (Binney), belong to the Arionidae. We have three indigenous species of slugs. Five species, all belonging to the Limacidae, have been introduced.

LIMAX MAXIMUS Linnaeus

Though relatively common in the San Francisco Bay region, records from southern California are few. Since it was formerly confused with *Limax marginatus*, at least some of the older records are no doubt referable to that species. The writer has never taken it in southern California. A single specimen in the Los Angeles Museum collection (No. 104) bears the following data, "Hallenbeck Park, Los Angeles, Calif., Dec. 4, 1923. Gordon Grant, collector." Live specimens collected by A. G. Smith in Golden Gate Park, San Francisco, Calif., were exhibited at the May, 1943 meeting of the Conchological Club of Southern California. No member present recalled having ever seen it in southern California. Mabel Guernsey [1] reported it as common at Laguna Beach, Orange County, Calif. Her statement, "*Li-*

[1] First Annual Report of the Laguna Marine Laboratory, Pomona College, p. 81, May, 1912.

max maximus is, when fully grown, about two inches long; *Limax flavus* is somewhat smaller," would indicate that she was unfamiliar with the species mentioned and that she was dealing with other slugs. In later years both Morris Caruthers and the writer have failed to find *L. maximus* at Laguna Beach.

It is said by some authors that this species will not eat green chlorophyllaceous vegetable matter. Specimens of *L. maximus* which I had in confinement did eat the dark green leaves of romaine. In addition to various tender vegetables they also ate raw beef and were observed to attack and readily devour live specimens of *Deroceras agreste* and *Arion intermedius*.

LIMAX FLAVUS Linnaeus

This is the largest of our common slugs in southern California. An unusually large specimen (preserved in 4% formaldehyde) collected in my yard at 2200 S. Harvard Blvd., Los Angeles, measures 4⅜ inches (112 mm.) in length. In a yard in Long Beach, I found a colony of about three dozen individuals which made their home in a fissure in the earth about eight inches deep. At night they would come out and crawl about the yard in search of bits of garbage. It is fond of fungus growths and is commonly found about rotten wood. I have frequently taken it in a cavity in a rotten log. At one time I examined a rotten tree trunk immediately after it had blown down and this species and *Limax marginatus* were found in cavities in the wood at least 12 feet from the bottom of the trunk. There were numerous slime trails over the outside of the bark. It is fond of tender vegetables and specimens in captivity have readily eaten lettuce, romaine, cabbage, carrot, potato and turnip. It was particularly found of romaine root.

A single specimen taken in El Monte, Calif., May 1, 1942, and which when fully extended to slender proportions measured 25 mm. long (approximately 30 days old) was placed in confinement and isolated from other slugs. It was fed principally on lettuce. It was approximately 2½ inches long on December 26, 1943 (about 634 days or 21 months old). On this date two eggs were deposited. Apparently self-fertilization had taken place as the eggs hatched 15 days later. On January 23, 1944, three more eggs were deposited but these were sterile. The two young specimens have since continued to grow.

I have personally collected *Limax flavus* from numerous localities in Santa Barbara, San Bernardino, Los Angeles and Orange Counties.

LIMAX MARGINATUS Müller

This species is second only to *Deroceras agreste* in its abundance and wide distribution in southern California. The writer has personally collected *Limax marginatus* from numerous localities in Santa Barbara, San Bernardino, Riverside, Los Angeles and Orange Counties. The collection of the California Academy of Sciences contains specimens from as far north as Kirkwood, Tehama County, California. In spite of its abundance and wide distribution, there are, to date, but two published records of its occurrence in North America. In 1917, Cockerell reported it from a greenhouse in Boulder, Colorado;[2] and again in 1930, he reported it from Santa Catalina Island.[3] The lack of records of this slug seems due to its confusion with certain color forms of *Limax maximus*. Internally *L. marginatus* is characterized by a posteriorly directed rectal caecum and a digitiform appendicular structure which is attached to the penis. Both of these structures are absent in *L. maximus*.

Specimens in confinement fed on decayed wood, lettuce, potato, turnip, cabbage and calla lily flowers. A lady once told me that something was ruining her calla lilies and that she suspected that the damage was being done by slugs. A few days later I received from her a small box containing two or three calla lily flowers. The slugs (*L. marginatus*) were there too, still eating.

Another interesting observation on *Limax marginatus* is the tendency to auto-urotomy, or self-amputation of the posterior end of the body. I have frequently noticed specimens in my yard with a noticeable constriction about three-fourths of the distance back from the posterior edge of the mantle. A specimen taken from my yard on May 30, 1943, showed this constriction quite pronounced with the area posterior to it shrunken as if from atrophy resulting from restricted circulation. The specimen was confined and furnished an abundance of food.

[2] Nautilus, vol. 30, p. 120, February, 1917.

[3] Ibid., vol. 52, p. 136, April, 1939.

Two weeks later the posterior end was quite filled out but a remaining slight constriction was definitely noticeable. When the slug was handled the constriction again became more pronounced. The only instances observed of complete self-amputation of the posterior portion of the body have been in specimens while in the drowning jar. I have before me a set of eleven specimens of *L. marginatus* taken in my yard on November 15, 1941. After drowning they were preserved in alcohol. Of these eleven, three show no signs of constriction; four show definite evidence of constriction; two are short with blunt posterior extremities, suggesting constriction when very young with consequent non-development of their tails; two, with definite constriction at time of collecting, accomplished complete self-amputation of their tails while in the drowning jar. Though this habit in *Prophysaon* has long attracted attention, it has apparently been overlooked in *Limax marginatus*.

Deroceras agreste (Linnaeus)

In southern California this is by far the most abundant species of slug, both in numbers and in locality records. There are numerous color forms which are united by complete intergradation. Interbreeding has been observed to take place between diverse color forms indiscriminately. Internally the species is characterized by a many lobed penial gland and by the presence of a rectal caecum. The penial gland varies greatly. There is absolutely no relation between the variation in color and the variation of the penial gland. Though described as having a pointed tail, certain of the fully mature individuals have a somewhat chisel-shaped tail resembling in this respect *Deroceras laeve* (Müller). Some of our color forms have been confused with *D. laeve*. The latter may be readily distinguished by the absence of a rectal caecum. *Deroceras agreste* usually exudes milky slime when handled roughly while *laeve* exudes clear colorless slime at all times. Though abundant in the San Francisco Bay region, I know of no instance of the occurrence of *Deroceras laeve* in southern California.

Deroceras gracile (Rafinesque)

This slug is quite generally distributed over Los Angeles and Orange Counties though I have at no place found it abundant.

This species has been confused with *Deroceras laeve*. *D. gracile* is smaller, more slender; has a pointed tail while *D. laeve* has a chisel-shaped tail when viewed in profile. The penis of *D. gracile* is spiral in form while that of D. laeve is hammer-shaped with three or four tubular glands. These differences were constant in all specimens examined in which there were fully developed male genitalia. The difficulty in making these determinations is that most specimens collected are in the female phase. In this female phase the female reproductive organs are mature and egg production has begun although male reproductive organs have not yet developed. Many individuals die after a period of active egg production and before the male genitalia have developed. Apparently only a small percentage of specimens enter the hermaphroditic phase in which the male organs as well as the female organs are fully developed. It is believed by some that there is an atrophy of the female organs resulting in a purely male phase. The numerous specimens which I have examined were either female or hermaphrodite. What is said here of these sex phases applies equally to both *gracile* and *laeve*. The truncate or chisel-shaped tail of *D. laeve* is to be looked for only in specimens approaching their maximum size. These large specimens with truncate tails have fully developed male genitalia. In my comparative study of these two species, which is by no means complete, I have utilized numerous living specimens of *D. laeve* from the San Francisco Bay region kindly furnished by Allyn Smith.

Specimens of *Deroceras gracile* from Los Angeles and Orange Counties are generally of a light slate gray with a gelatinous appearance although in some colonies the specimens are nearly black with the dark pigment diffused over a dark brown background.

Milax gagates (Draparnaud)

Fairly common. Specimens have been collected in Santa Barbara, Los Angeles, Orange and San Diego Counties. Most of these varied from dark gray to nearly black. The lighter colored specimens were more heavily pigmented along the longitudinal grooves. Specimens from Refugio Canyon, Santa Barbara County, were much lighter than any of the others with a

decided yellowish cast while the slugs were living but less noticeable in the preserved specimens. A single large specimen from Elysian Park, Los Angeles, had a definite dorsal stripe of the keel, suggesting *M. sowerbii* (Férussac). It had the characteristic globose spermatheca which would identify it as *gagates*.

ANADENULUS COCKERELLI (Hemphill)

When originally described the type locality was given as Cuyamaca Mts., San Diego County, Calif. Hemphill's types, now in the California Academy of Sciences, are indicated as being from "Julian, San Diego County, Calif." For over fifty years *Anadenulus* was known only from the type lot originally collected by Henry Hemphill. The writer has succeeded in finding specimens at the following localities: Upper Millard Canyon, San Gabriel Mts., Los Angeles County; Calbaden Canyon, Puente Hills, Los Angeles County; Carbon Canyon, Puente Hills, Orange County; Limestone Creek above Santiago Reservoir, Orange County.

This species bears a superficial resemblance to a small specimen of *Prophysaon andersoni* but the tripartite sole of *Anadenulus* is sufficient for easy recognition. One specimen, apparently fully adult, measures 28 mm. long when fully extended. The longest preserved specimen in my collection measures 20 mm. The color varies. Some individuals are nearly black. Young specimens are generally darker than adult specimens. There are generally two undulating longitudinal yellow stripes on the mantle. These may be bordered on either side by black stripes. In a specimen from Millard Canyon the outer black stripes are conspicuous with the area between the two yellow stripes only slightly darker than the yellow stripes themselves. The distinct dorsal keel is lighter in color than the rest of the back and in some individuals there is a definite dorsal stripe. The distinctly tripartite sole is irregularly dotted with black. These black dots are more numerous along the longitudinal grooves which separate the median area of the sole from the lateral areas.

HESPERARION HEMPHILLI (Binney)

Previously known only from Alameda and San Mateo Counties, the writer has found it to be quite widely distributed in

the wooded canyons in Los Angeles and Orange Counties. I have taken it in the following southern California localities: Elysian Park, Los Angeles; Arroyo Seco Canyon, Millard Canyon and Santa Anita Canyon, San Gabriel Mountains, Los Angeles County; Santa Ana Canyon, Black Star Canyon, Silverado Canyon and Trabuco Canyon, Santa Ana Mountains, Orange County.

Southern California specimens are somewhat darker along the dorsal area than specimens I have seen from the San Francisco Bay region but they have the characteristic markings on the sides and the milky white sole. Internally the structures agree with descriptions of the northern specimens.

BURCHIA, A NEW GENUS OF TURRIDS

By PAUL BARTSCH

Thanks to the kind offices of Mr. Thomas A. Burch of Redondo Beach, California, I have been able to examine the animal of paratypes of the mollusks that he described (Nautilus, vol. 52, 1938, pp. 21–22) as *Pseudomelatoma semiinflata redondoensis*, dredged by him in 25 fathoms on gravel bottom off Redondo Beach. The placing of this mollusk was quite puzzling. In shell characters it suggests the African *Clionella*, whose type is *Buccinum sinuatum* Born. The radular structures, however, quite remove this from that relationship, for *Clionella* has a rachidian tooth as well as Y-shaped marginals, which places it in the subfamily Clavatulinae. Burch's mollusk, on the other hand, shows not a trace of a rachidian tooth, but possesses Y-shaped marginals only, a character that places it in the subfamily Turrinae. Since there is no genus in this subfamily to which *redondoensis* may be referred, I here propose for it the name:

Burchia, new genus

Shell large, turrited, covered by a strong periostracum. Nuclear whorls small (badly eroded in all our specimens). Postnuclear whorls with a concave sinal area which extends over the posterior third of the turns. The anterior two-thirds are convex

and crossed by strong, low, broad, retractively slanting axial ribs which evanesce on the base. The sinal area shows a few incised spiral lines, while the entire rest of the surface bears feeble, rather distantly spaced, spiral threads which become intensified on the base and columella. Suture well impressed. Base moderately rounded. Columella short and stout. The aperture is ovate. The outer lip with a deep posterior V-shaped sinus below the summit; anterior canal rather broad; inner lip reflected over the columella and parietal wall as a heavy callus which may be somewhat thickened at the posterior angle of the aperture. Operculum small, oval, with a low ridge on the right side and apical nucleus, marked on the outside by concentric lines of growth. Radula with Y-shaped marginals only.

Type: *Burchia redondoensis* (Burch) (= *Pseudomelatoma semiinflata redondoensis* Burch).

Here I am likewise placing *Burchia clionella* (Dall) (= *Leucosyrinx ? clionella* Dall) described in 1908 in the Bulletin of the Museum of Comparative Zoology, volume 43, page 270. The type, U.S.N.M. No. 123125, of this species was dredged by the U. S. Bureau of Fisheries steamer *Albatross* at station 3394 in the Gulf of Panama in 511 fathoms. An additional series of specimens, U.S.N.M. No. 97069, was dredged by the *Albatross* at station 2792 off Manta, Ecuador, in 401 fathoms. These specimens agree in radular characters as well as shell appearance with Burch's species.

TAXONOMIC HEADACHES

By PAUL BARTSCH

"The Sphaeriidae, a Preliminary Survey," Brooks and Herrington, Nautilus, vol. 57, pp. 93–97, is most interesting and I hope as the title indicates will result in their preparation of a summary volume upon this family.

Shortly after coming to Washington, almost a half century ago, we had a visit from Dr. Sterki, and the two of us in our leisure hours combed the streams about the nation's capital for fresh-water mollusks. This gave me an excellent opportunity of becoming acquainted not only with Sterki as the man (a lovable character) but his wide knowledge as a field naturalist and a laboratory worker. His knowledge was not confined to Mol-

lusca but he was equally versed in Protozoa as attested by many of his observations published in Bronn, Die Klassen und Ordnungen des Tierreichs, vol. 1, Protozoa, by O. Bütschli.

About a quarter of a century later, when a great deal of the miscellaneous determinations we are called upon to make, fell upon my shoulders, I came to realize that our collections of *Sphaerium*, *Pisidium* and similar folk were in a chaotic nomenclatorial state and I prevailed upon Dr. Dall to persuade Dr. Sterki, who was at that time deemed the only man who really knew the subject, to come to Washington and revise our collection, which he did.

A lot of this material he seemed to easily allocate; a lot he asked to be sent to him for more detailed study. Some of this was returned definitely determined by him, and some with "?"

Dr. Sterki possessed unique eyes, eyes that were not confocal so that when critical comparison requiring low power magnification was made he would shove his spectacles upon his forehead and hold the specimens within a couple of inches of his right eye, attaining thereby a considerable magnification—a decided advantage over the ordinary mortal. I am mentioning this fact which I believe has not before reached print.

In the years following his revisional visit, we sent him all things that stumped me in the groups in question, of which quite a bit became type material. This brings me to another phase of Sterki: In spite of all my urging to have him designate a type and type locality, most of his species were described without this, and given a wide zoogeographical range. This distribution seemed in many instances almost fantastic.

Since then, however, a new phase of *Ornithology*, Bird Banding, has developed, in which I believe I put forth the first effort in America, and this has resulted in the acquisition of an immense amount of information, covering, among other things, the flyways of our waterfowl, ducks, herons and waders, which in turn throws a flood of light upon the distribution of those small bivalves and other aquatic things carried from place to place by these birds.

I hope when Brooks and Herrington begin plotting the distribution of the species, subspecies, etc., they may have a flyway chart before them and check its bearing upon this distribution

problem. It is interesting in this connection to note how some of our waterfowl still follow the westward course at the foot of the glaciers of long ago, when they proceed westward from the eastern seaboard.

Then there is a second problem, probably the much greater, namely, the question of hybridization. This, when specifically distinct species are able to mate, appears to produce not Mendelian features such as we get in intraspecific crossings, but an endless number of variants most of which, as far as experiments in mollusk breeding show, are evanescent, but some are capable of continuing their kind. Some of these mutating complexes occupy limited areas and may be the result of a mixing of an immigrant waif with a local race. It seems to me what is necessary in the study of these small bivalves is the gathering of a large series of specimens (not a few isolated individuals as usually reach the Museum taxonomists) to seew how fixed or variable the forms from each locality may be. Experimental breeding also seems indicated. Finally I am mindful that when one uses aquaria, in many cases a depauperization occurs in succeeding generations due to possibly a change in P_h or food, or a combination of other ecologic factors. I can't help but feel that immigrants brought into new environments may respond similarly.

The working laboratory taxonomist pondering upon the whence and why does not face an easy task in endeavoring the fixation of a name that is to hold for all time to come.

The geologic record, interesting as it may be, will furnish more factors but not a complete solution, for the days of yesterday presented problems with as many ramifications and interdigitations as the problems of today.

PERUVIAN LAND MOLLUSCA—II

By HENRY A. PILSBRY

The following snails were selected as new from a long series of Peruvian species sent by Dr. W. Weyrauch of Lima. They were collected by him during travels in the interior in the course

of his work on economic entomology. Further species will form a third installment of this series.

PSADARA PIZARRO, new species. Plate 11, Figs. 6, 6a

The very thin shell is narrowly umbilicate, the spire convex, periphery well rounded. The 4⅓ whorls are convex and joined by a deeply impressed suture, the last whorl only very slightly descending in front. Color very pale brown marked with three narrow dark brown bands which are interrupted into hyphen-shaped spots, the spots of the upper series connected with the suture by short radial brown streaks; the first 1½ whorls whitish. The surface is dull, the first whorl smooth, next whorl with close microscopic radiating striae. Subsequent whorls have low uneven wrinkles of growth and low papillae arranged in obliquely descending order though not very regular; on the base the papillae become lower. The aperture is wide, lunate, the peristome rather narrowly expanded in its outer and basal margins, dilated near the axial insertion, covering a small part of the umbilicus. Height 11 mm., diameter 18.7 mm.

Yanango, near Huacapistana, Peru, at 1800 meters. Type 180355 ANSP.

It belongs to the group of *P. catenifera* (Pfr.), of Colombia, and differs from *P. incarum* (Philippi) and other Peruvian species by the convex spire.

EPIPHRAGMOPHORA ATAHUALPA, new species. Plate 11, Figs. 4, 4a, 5

The shell is umbilicate, the umbilicus rapidly widening in the last half turn, contained about 4¼ times in the diameter; depressed, the height contained 2.4 times in the diameter, the spire being but slightly convex, the periphery rounded. Color warm white with a chocolate band about 1.6 mm. wide above the periphery, bordered by a whitish band of the same width above and a wider one below. The peripheral whitish band is followed by a cinnamon-brown band, fading at its lower edge. The upper surface has a dull chamois tint above the light band, with two rather faint cinnamon-brown bands. The surface is glossy, with scupture of fine, unequal growth wrinkles and a fine, weak malleation on the last whorl, which also shows some scattered traces of weak spiral grooves, the embryonic 1⅓ whorls being smooth. The rather weakly convex whorls increase slowly to the wide last turn. The suture descends rather deeply to the aperture. The aperture is strongly oblique, rounded, a little wider than high, showing dark and white bands inside. The

peristome is nearly white, the parietal wall forming less than one-fourth. It is narrowly reflected on the outer and basal margins, and the upper arc, which is less curved, is narrowly expanded.

Height 12.3 mm., diameter 29.5 mm.; width of aperture with peristome, 14.2 mm.; 4½ whorls.

Andahuaylas, Peru, 3100 meters elevation. Type 180206 ANSP.

This species resembles "*Helix*" *macasi* Higgins[1] in general form and coloration. It differs by the smaller aperture, its greatest width less than one-half of the diameter of the shell. In Higgins' figure of mascasi, as well as in that of Kobelt,[2] the width of aperture exceeds half of the diameter. The width of umbilicus is about alike, being contained about 4.25 times in the diameter in our shell, and in *macasi* about 5 times. In Kobelt's figure it is distinctly smaller, contained 7 times in the diameter. Both of these authors give the number of whorls as 5, while our shell has only 4½.

In view of these differences, and the rather wide separation of the localities, a specific status for the Andahuaylas snail seems indicated.

Fig. 5 is a smaller form of the species, from Ninabamba, near Ayacucho, Peru, at 1900 meter elevation. The specimen figured measured 23.5 mm. diameter, another 27.2 mm.

Bulimulidae

When I revised the classification of the Bulimulidae nearly fifty years ago the genus *Bulimulus*[3] was left with rather wide limits. The subgenera were grouped in three divisions according to the sculpture of the apical whorls. As genera are somewhat more narrowly limited now, it seems desirable to allow some groups of Bulimuli the generic status. I am therefore treating the mainly Peruvian "Division I, Bulimuli with smooth apical whorls"[4] as genus *Bostryx*. The limits of *Bostryx* remain as in Man. Conch. 10: 127–193.

[1] Proc. Zool. Soc. 1872, p. 686, pl. 56, figs. 6, 6a. Macas, Ecuador.

[2] Syst. Conchylien-Cabinet, *Helix*, pl. 182, figs. 10–12.

[3] 1896, Nautilus 9: 112; Man. Conch. 10: 127; 1902, Man. Conch., Supplement to vol. 14, p. xxii.

[4] Nautilus 9: 114; Man. Conch. 14, Suppl. p. xxiii.

As in some other genera of Bulimulidae, the general shape of the shell is widely varied. Our fig. 19 represents one of the most slender species, and fig. 8, *Bostryx (Platybostryx) weyrauchi,* one of the shortest; but there are many transitions between these extremes.

THAUMASTUS (*Scholvienia*) WEYRAUCH, new species. Plate 11, Figs. 2, 2a

The shell is perforate, turreted, slender, regularly tapering to an obtuse apex, moderately solid though rather thin; nearly black with a narrow white band nearly 1 mm. below the suture and two about 1.5 mm. apart in the peripheral region, the upper peripheral band being visible above the suture on the spire; there is also a small light umbilical area. The apex is turned in, the first whorl subangular above with sculpture of thin axial riblets, the second rounded and somewhat shouldered, with strong axial riblets extending to the middle of the whorl, the lower half having fine striae. Later whorls are regularly and rather weakly convex. The oval aperture is acutely angular, above, broadly rounded at base, showing the bands within. The peristome is whitish, rather narrowly expanded, the columellar margin reflected. Parietal callus very thin and transparent.

Length 39.5 mm., diameter 15 mm.; length aperture 15.7 mm.; 6½ whorls. Type.

Length 46.5 mm., diameter 16 mm.

Carpapata, on the Rio Tarma, near Palca, Peru, 2300 meters. Type and paratype 179996 ANSP.

This is a slender, vividly colored species, with the apical sculpture strongly developed.

THAUMASTUS ROBERTSI SATIPOENSIS, new subspecies. Plate 11, Fig. 1

This shell is more slender than *T. robertsi* Pilsbry, with the apical whorls forming a higher, narrower cone.

Length 74.4 mm., diameter 34 mm.; length of aperture with peristome 39.6 mm.; 6¼ whorls.

Satipo, near Huancayo, Peru, at 600 meters. Type 179990 ANSP.

BOSTRYX HUARAZENSIS, new species. Plate 11, Fig. 17

The shell is ovate with short, conic spire and a rather large umbilicus; white with interrupted bands of dark brown. In the type the last whorl has a series of small spots against the

suture, and two nearly continuous narrow bands, one in the middle of the upper surface (and ascending the spire), the other just below the periphery. The upper band is surmounted by a series of oblong spots which are partially connected at their upper ends. There is a double spiral series of dots at the periphery and another on the base. The whorls are rather strongly convex, the first 2½ uniform dull buff, smooth; subsequent whorls with irregularly spaced and partly rather coarse wrinkles of growth. The ovate aperture shows the bands within. Peristome thin and sharp, the columellar margin dilated above, white.

Length 16.5 mm., diameter 11.4 mm.; aperture 8.5 mm. long; 6 whorls.

Huarez, Santa Valley, 3100 meters elevation. Type 180000 ANSP.

Closely similar to *B. tumidulus* (Pfr.), but it is wider and more openly umbilicate.

Bostryx megomphalus, new species. Plate 11, Figs. 15, 16

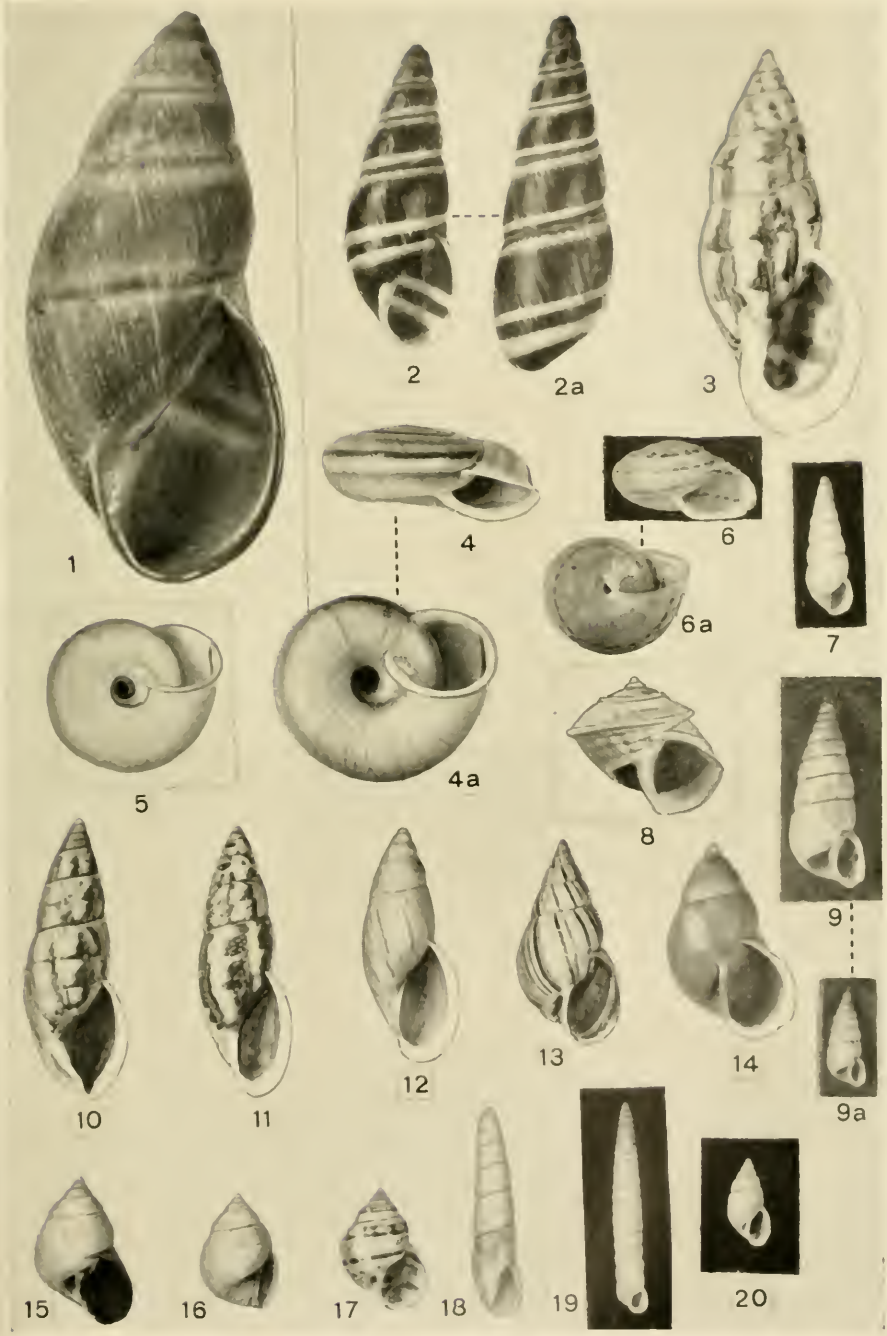
The shell is ovate with a nipple-shaped apex and large umbilicus contained about four times (more or less in different examples) in the diameter; rather thin but calcareous; white, with some small dark dots scattered on the spire. It becomes gray towards the lip. Surface matt, the embryonic whorls smooth, the later whorls having irregular, low wrinkles of growth. The initial 1½ whorls are quite convex, following whorls somewhat flattened, with a peripheral angle or low keel which is to a greater or less extent covered by the following whorl. Last whorl is rounded at periphery and narrowly rounded around the umbilicus. The ovate aperture is somewhat oblique, claret brown within. Peristome thin and sharp, the terminations approaching, outer margin unexpanded, the columellar margin running forward, dilated and claret brown.

Length 19.3 mm., diameter 13 mm.; length of aperture 10 mm.; 6⅓ whorls. Type.

Length 15.8 mm., diameter 11.6 mm.; length of aperture 8.4 mm.; 6 whorls.

Acobamba (near Tarma), Peru, 3200–3400 meters elevation. Type and paratypes 180036 ANSP.

This species belongs to a little group including *B. binghami* Dall and *B. ptyalum* Dall (Proc. U. S. Nat. Mus. 38: 180, 181), from the Rio Pampas. Both are larger than *B. megomphalus*. *B. ptyalum* has a dark interior, like *megomphalus*, but it differs by having spiral striation and in various details of shape.



Peruvian Land Mollusks.

The mucronate apex in *B. megomphalus* varies in color, being uniform white in some examples, in others bicolored, white above and dark below, or entirely dark. The extent of dusky suffusion on the latter part of the last whorl varies, and in some examples it is wanting or faint. In one shell there is a brown band at the lower third of the third whorl.

Bostryx derelictus ascendens, new subspecies. Plate 11, Fig. 14

The base around the umbilicus is broadly rounded, not compressed and almost to be called bluntly angular, as it is in *derelictus*.

Length 26.2 mm., diameter 16 mm.; length aperture 14 mm.; 6½ whorls.

Ninabamba, near Ayacucho, Peru, 1900 meters elevation. Type 180017 ANSP.

Bostryx abancayensis, new species. Plate 11, Fig. 20

The ovate shell has a conic spire and rather narrow umbilicus. It is white, becoming pale brown on the spire and apex. The whorls are moderately convex, joined by a well impressed suture. The surface is slightly glossy, marked with very slight growth lines, but the last whorl becomes somewhat plicate as it approaches the aperture. The ovate aperture is white within. Peristome sharp, unexpanded, but thickened within.

Length 9.2 mm., diameter 5 mm.; length of aperture 4.2 mm.; 5¾ whorls. Type.

Length 11.4 mm., diameter 5.7 mm.; length of aperture 5.2 mm.; 6⅓ whorls.

Abancay, near Cuzco, Peru, 2300 meters elevation. Type and paratype 180001 ANSP.

Bostryx (*Peronaeus*) anomphalus, new species. Plate 11, Fig. 7

The turreted shell has an almost closed umbilical perforation, and tapers regularly to the slightly obtuse apex. It is white with gray dots quite irregularly scattered. The somewhat glossy surface is smooth except for very inconspicuous lines of growth. The apex is somewhat obtuse, sometimes with a brownish tip, but white in other shells. The whorls are moderately convex, the last two sometimes a little more convex than those preceding. Suture well impressed. The aperture is oblique,

peristome thin, the columella straight, its margin reflected and appressed, nearly closing the perforation.

Length 18.2 mm., diameter 5.9 mm.; length of aperture 5.3 mm.; 9¾ whorls. Type.

Length 17.8 mm., diameter 5.7 mm.; length of aperture 5 mm.; 9¾ whorls.

Santa Eulalia Valley, near Chosica, Peru. Type and paratypes 180002 ANSP.

It agrees with *B. acromelas* (Morelet) in the almost closed umbilical fissure and the scattered dots, but it is less slender and not cylindroid in the lower part.

Bostryx (*Geoceras*) multivolvis, new species. Plate 11, Fig. 19

The shell is minutely subperforate, column-shaped, the upper third tapering; white, the upper 8 or 10 whorls faintly brown tinted with a few indistinct brown streaks. The surface is slightly glossy, with sculpture of very weak lines of growth, the first whorl smooth. The shell increases slowly in diameter up to about the twelfth whorl, after which it is cylindric. The whorls are rather weakly convex, the last being bluntly angular at the periphery, the base very slightly convex. The small aperture is oblique. Peristome thin and unexpanded, the columellar margin reflected and appressed except for a very minute crevice.

Length 27.8 mm., diameter 4.2 mm., at the penult whorl 4 mm.; length of apertures 3.2 mm.; 22½ whorls.

Ninabamba (near Ayacucho), Peru, 2000 meters elevation. Type 179994 ANSP.

This strange bulimulid shell is related to *B. cuspidatus* (Morelet), but of narrower form. It is more slender than any other Geoceras known, and has more whorls.

Bostryx (*Phenacotaxus*) endoplax, new species. Plate 11, Figs. 9, 9a

The regularly tapering, conic shell is slender, the diameter less than half of the length, broadly umbilicate, the umbilicus occupying about one-third of the diameter; warm white with a few indistinct brownish streaks. Surface matt, the first two whorls smooth, the rest evenly sculptured with close, thread-like striae about equal to their intervals. The whorls are nearly flat, joined by an impressed suture, the last whorl convex, carinate around the umbilicus. The rather narrow aperture is angular above and bluntly angular at the base. Peristome thin and simple, the margins approaching above. The large columellar

axis bears a horizontal lamella in the latter half of the penult and beginning of the last whorl. This lamella becomes very broad, reaching nearly to the outer wall in the latter part of the penult whorl, and its edge is strongly thickened there.

Length 11.9 mm., diameter 5 mm.; 8¾ whorls.

Length 12 mm., diameter 4.7 mm.; 8½ whorls.

Ninabamba, near Ayacucho, Peru, at 1900 meters elevation. Type and paratype 180006 ANSP.

It is larger and more strongly tapering than *B. endoptyx* Pils. (Notulae Naturae No. 56), from Huánuco, in the Huallaga river valley, Peru.

Drymaeus angulobasis, new species. Plate 11, Fig. 10

The fusiform shell is rather openly umbilicate but the cavity narrows rapidly to a narrow perforation; moderately strong; white, with festooned axial stripes of dull plum purple (nearly black) speckled with white, and crossed by three narrow, interrupted spiral bands of the same dark color, a brownish smear behind the lip. There are 7 whorls, the first with *Drymaeus* sculpture, the rest weakly convex with low growth wrinkles; the last whorl concave above a prominent rounded ridge around the umbilicus. The aperture is vertical, oval, angular at both ends, being spout-shaped at the base. The peristome is white, expanded and sharp-edged, thickened within, with a purple interior, darkest on the callus within the lip. Columellar margin concave, purple within, reflected. The thin parietal callus is purple.

Length 37 mm., diameter 13.5 mm.; aperture 16 mm. long.

Oreja de Capelo, Peru, 1600 meters elevation. Type 180022 ANSP.

The type of this species was associated with the following *Drymaeus* which I have referred to *D. interpictus* (Martens), as a special "form." *D. subhybridus* (Da Costa) is a decidedly wider shell, but apparently near akin.

Drymaeus interpictus (Martens) form *diversipictus*, new form. Plate 11, Fig. 11

These shells have broad, irregular axial stripes flecked with white dots, and with traces of two or three spiral, interrupted bands of almost black color. It differs from *interpictus* in markings, that species have narrower, straight stripes. The rather widely expanded lip is pure white on both sides, hardly

thickened within. Interior purple, darkest near the white lip. There is a small white umbilical area.

Length 35.4 mm., diameter 12 mm.; aperture 16.4 mm. long; 6¾ whorls.

Orejo de Capelo, Peru, 1600 meters elevation. 180021 ANSP.

Drymaeus punctatus Da Costa. Plate 11, Fig. 12

The fusiform shell is subperforate, of colonial buff color, with, on the last two whorls narrow brown stripes dotted with white, a cinnamon-rufous streak behind the lip. Whorls slightly over 6, the later ones rather weakly convex, the earlier more strongly convex. The aperture is slightly more than half of the length, long ovate, broadly rounded at base, lilac within the lip, fading to white with dusky stripes farther in. The rather broadly expanded outer and basal margins of the peristome are white. Columellar margin narrow, but triangularly reflected above, reducing the perforation to a minute crevice. Parietal callus dull bluish violet.

Length 31 mm., diameter 12.7 mm.; length of aperture 16.3 mm.

Rio Toro, Chanchamayo valley, Peru, 1400 meters elevation. 179997 ANSP.

It resembles *D. punctatus* Da Costa closely, but differs somewhat in color.

Drymaeus torallyi peruvianus, new subspecies. Plate 11, Fig. 13

The shape and color are much as in *D. torallyi* (Orb.), from which it differs by the decidedly more open umbilicus and stouter, less slender shape. The shell is moderately solid, opaque, white with numerous unevenly spaced hazel stripes, with carob brown stripes at wider intervals; the apex dusky, interior of umbilicus carob brown.

Length 27.3 mm., diameter 13.5 mm.; length of aperture 12.9 mm.; 7½ whorls.

Huaraz, Santa Valley, Peru, 3100 meters. Type 180008 ANSP.

D. torallyi was described from the provinces of La Laguna and Valle Grande, Bolivia. A form perhaps identical with our *peruvianus* was reported from near Camana, west coast of Peru, at 2000 ft. elevation (Dall, 1912, Smiths. Misc. Coll. 59, No. 14, p. 2).

DRYMAEUS FLEXUOSUS MEGAS, new subspecies. Plate 11, Fig. 3

Specimen collected by A. A. Olsson from near Suesa, in the upper Magdalena valley, Dept. of Huila, Colombia, are marked like *D. flexuosus* Pfr. of Marmato, Colombia, but the shell is larger and more solid, with broadly expanded white lip, the interior pale bluish lavender and showing the external dark markings.

Length 50.3 mm., diameter 21 mm.; length of aperture 24.8 mm.

Type 179981 ANSP.

SUBULINIDAE

OBELISCUS LATISPIRA, new species. Plate 11, Fig. 18

The shell is imperforate, slender, slowly tapering to the obtuse apex. Color, rather pale straw yellow. Surface glossy, with sculpture of rather weak, arcuate wrinkles of growth. The whorls are nearly flat, joined by a moderately impressed and quite obliquely descending suture. The summit is rounded. Aperture is oblique, narrow with straight outlines in the upper half, the base broadly rounded. The columella is somewhat thickened.

Length 27.5 mm., diameter 6.2 mm.; length of aperture 6.8 mm.; 9 whorls.

Huacapistana, Peru, at 1800 meters elevation. Type and paratype 179987 ANSP.

By its thick spire this snail stands near *O. pairensis* (Higgins), of Ecuador, but the Peruvian species is smaller and more slender. The type is a faded specimen, so that the color assigned is that of an immature paratype 19.2 mm. long.

VERTIGO PARVULA STERKI

BY GORDON K. MACMILLAN

Carnegie Museum

In 1890 Dr. V. Sterki described a new North American *Vertigo* as *V. parvula* (Naut., 3, 136). Seven years later, apparently having forgotten that he had described *parvula*, Sterki redescribed it as *Vertigo minuscula* (5th. Ann. Rept. Ohio State Acad. Sci., 1897, 29). However, Dr. Sterki first mentioned the

existence of *V. minuscula* in the 3rd. Ann. Rept. Ohio State Acad. Sci., 1895, 34.

In "Notes on some Northern Pupidae with Description of a New Species," appearing in the number of the Nautilus mentioned above, Dr. Sterki made the following notation:

Among several hundred Pupidae collected in Northwestern Ohio (Summit and Lake Counties) by Mr. A. Pettingell, there were two examples of a doubtless new species, which I in the same way name *V. parvula*. It is about the same size, shape, and appearance of *V.* (*Angustula*) *milium* Gld.; but ranges in quite another group, having a quite simple palatal wall and margin, and only 3 lamellae."

Dr. H. A. Pilsbry, Manual of Conchology, 25, 1919, 105, gave Summit County, Ohio, as the type locality for *parvula*, and said that it was also found by A. G. Wetherby in the Mountains of North Carolina according to Dr. Sterki.

Mitchell County, North Carolina, was the first definite locality given for *parvula* in that section of the country by H. A. Pilsbry and E. G. Vanatta in "A Partial Revision of the Pupidae of the United States" (Proc. Acad. Nat. Sci. Phila., 52, 1900, 608).

Dr. Sterki, in "Some Notes on Recent Mollusca of Ohio" (3rd Ann. Rept. Ohio State Acad. Sci., 1895, 34), makes the following notation:

About five years ago, among numerous Pupidae kindly sent by Mr. A. Pettingell of Hudson, O., two specimens of a small Vertigo were found, different from all species known. They were mature and exactly alike; yet it was considered unsafe to establish a new species upon them. This year (1894) a few more were seen among material collected in the mountains of North Carolina by Prof. A. Wetherby, formerly of Cincinnati, and sent for examination, and thus the validity of this species was confirmed. Probably it has its main distribution in the North, and extends southward in the Alleghenies, as so many other animals and plants do. It is named *Vertigo minuscula*.

On page 35 of the above mentioned publication Dr. Sterki gave Summit County as the locality for *minuscula*.

The description of *V. minuscula* appeared in an article entitled "Analytical Keys for Identifying the Land Mollusca of

Ohio'' (5th Ann. Rept. Ohio State Acad. Sci., 1897, 29). This is given below:

Alt. 1.5, diam. scarcely 1 mill.; sh. thin, horn colored, translucent; palatal wall without crest and inside callus, with one (the inferior) small fold; 1 parietal, 1 columellar; peristome scarcely everted; alt. 1.4, diam. 0.8 mill.

For comparison Dr. Pilsbry's description of *V. parvula* (Man. Conch., 25, 1919, 105) is given below. I have italicized the words that correspond to Dr. Sterki's description of *V. minuscula:*

The shell is minute, subcylindric, tapering very little upwards, the summit obtuse; *thin, subtransparent, slightly yellowish,* smooth and glossy, becoming finely striate behind the outer lip. The whorls are moderately convex, the last whorl well rounded, slightly impressed behind the projection of the outer lip. The aperture is somewhat triangular, with three teeth: *parietal lamella* rather short and high; *columellar lamella* short, steeply ascending inwardly; *lower palatal fold* rather high in front, rapidly becoming lower as it recedes, penetrating to the dorsal side. *Peristome very little everted,* slightly thickened, and having a distinct callus ridge within. The outer lip projects forward and is slightly bent inward above the middle. *Length 1.55, diam. 0.85 mm.;* barely 5 whorls.

In one Dr. Sterki's handwritten catalogues of North American Pupidae he mentions two sets of *V. parvula.* The first was collected by A. Pettingell in northeastern Ohio, ''Summit or Lake County,'' the type specimen, which was figured by Dr. Pilsbry in the 25th volume of the Manual of Conchology. The second set, consisting of two specimens, is from Hollow Poplar Creek, Mitchell County, North Carolina, and collected by A. G. Wetherby in 1894.

Vertigo parvula has precedence over *V. minuscula,* based on a priority in time, and for this reason *V. minuscula* becomes a synonym of *V. parvula.*

A SMALL COLLECTION OF LAND SHELLS FROM NEBRASKA

By GORDON K. MacMILLAN

Carnegie Museum

During the summer of 1941 the Carnegie Museum Expedition for Vertebrate Fossils, under the leadership of Dr. J. LeRoy Kay, spent a few days in northwestern Nebraska, with the First Field Conference of Vertebrate Paleontology, on its return eastward. In the short time spent in this section of Nebraska I had the opportunity of collecting some mollusks at two localities, northwest of Crawford and at Agate.

The western section of Nebraska consists of soils which vary from those of fine texture to those of rough stony land, with frequent rock outcroppings, including broad plateaus, deep and steep-walled canyons, bold escarpments, buttes, and here and there areas of "bad lands." This area, the plains region, is characterized by short-grass communities, dominated by grama grass, buffalo-grass, and certain grass-like sedges, and with straggling western yellow pines scattered over the canyon sides, the buttes, ridges, and the talus slopes. The topography consists of broad, slightly uneven, grassy plains, streams running in canyons which are frequently deep and rock-walled, dry "sand-draw" canyons carrying water only after rains or from melting snow, rocky escarpments, ridges and buttes with scattering pines, deciduous trees or shrubbery in the bottoms of the canyons, along the streams, or about the ranches, and an increasing amount of cultivated land.

The "bad lands," due to excessive erosion, is a habitat in the plains region, and is characterized by their sparse flora and fauna, restricted to only those forms which can withstand the severe conditions of this environment.

About eight miles northwest of Crawford, approximately between Remington and Orella, a small branch of Sand Creek, itself a tributary of the White River, has cut a wide canyon through the bad lands of that section of Dawes County. The rains, snows, temperatures, and winds have had their eroding effects in this area, exposing the white sands and fine clays in a

steep outcrop a few hundred yards from State Highway No. 2. From the face of this outcrop were collected *Succinea grosvenorii* Lea and *S. oregonensis* Lea. It is presumed that these amphibious snails were originally from this outcrop as they were white and devoid of epidermis. In the field above the outcrop there were no lakes or other types of water from which it was possible for these snails to have originated.

At the base of a small "sand-draw" the small branch of Sand Creek had deposited a fine layer of particles of vegetation from which were gathered the following species of land snails:

Gastrocopta pentodon (Say) *Hawaiia minuscula* (Binney)
Vallonia costata (Muell.)

At Agate, in Sioux County, Capt. James H. Cook established a cattle ranch extending ten miles on both sides of the Niobrara River. The water from this river has been used for irrigation purposes, some of the ditches traversing the lawn of the ranch. Along these ditches are found growing cottonwoods, willows, small bushes and shrubs. A number of small forms of terrestrial mollusca were found under the layer of leaves and logs and branches close to the edge of the ditches under the willow growths or shaded places in the stands of cottonwoods. The species are:

Succinea grosvenorii Lea *Vallonia albula* Sterki
Vertigo ovata (Say) *Vallonia costata* (Muell.)
Vallonia costata montana Sterki

The discovery of *Vallonia costata montana* (teste Pilsbry!) at Agate, Neb., extends the distribution of this variety farther eastward than hitherto known. Previous to that time the distribution of *V. c. montana* was confined to an area that included eastern Idaho, northeastern Utah, central and western Colorado, Wyoming, and eastern and southwestern Montana. The easternmost distribution, that closest to Agate, Neb., is Laramie, Wyo., which is approximately 120 miles northeast of the latter locality.

The Niobrara River at Agate has cut a winding course through and across the uneven plains of that section of Sioux County, exposing steep banks of white sands. These banks are consid-

ered either of late Pleistocene or early modern times. From one of these banks in the bend of the river, about 500 yards from Agate, the following terrestrial mollusca were collected:

Hawāiia minuscula (Binney) *Vallonia costata* (Muell.)
Vertigo ovata Say *Succinea grosvenorii* Lea
Succinea oregonensis Lea

Species of *Physa, Lymnaea, Helisoma, Gyraulus,* and *Sphaeriidae* were also dug from the bank, which contained also the jaw of a young *Bison* about fifty feet from the top of the exposure.

AN OVERLOOKED DESCRIPTION OF A NORTH AMERICAN GASTROPOD

By GORDON K. MacMILLAN

Carnegie Museum

Joseph True described a new gastropod, which, as far as I can ascertain, has not been mentioned in any of the leading works on North American conchology or in any of the monographs on *Helix.* This overlooked shell appeared in the Proceedings of the Essex Institute, vol. 2, 1857, p. 193, as "*Helix minima,* True, sp. nov.?" and was described as follows:

An exceeding small species—shell, minute, rounded-conical, smooth apex abtuse, epidermis of a uniform reddish horn color; whorls four, rounded above, and below, with a well defined suture. Aperture rounded, lip simple and thin, umbilicus broad and deep. Diameter about one-twentieth of an inch.

Helix minima was collected at Salem, Mass., and was "found under loose stones, wood, and decayed leaves, within half a mile of Great Swamp-meadow, which is situated in the limits of Salem." This species was associated with (I modernize the nomenclature): *Mesodon albolabris* (Say), *Anguispira alternata* (Say), *Strobilops labyrinthica* (Say), *Hawaiia minuscula* (A. Binney), *Haplotrema concavum* (Say), *Discus cronkhitei anthonyi* (Pils.), *Zonitoides arboreus* (Say), *Retinella electrina* (Gould), *R. indentata* (Say), *Helicodiscus parallelus* (Say), *Euconulus chersinus* (Say), and *Vallonia pulchella* (Muell.).

From the above description I am inclined to call *Helix minima* a synonym of *Punctum minutissimum* (Lea). The broad and deep umbilicus places it close to *Striatura milium* (Morse) and *S. ferrea* (Morse), but these are much lighter in color than *Helix minima*, which is closest in that character to *P. minutissimum*.

This is not *Helix minima* of E. F. Schlotheim, Mineralogisches Taschenbuch, 1818, 340, nor *Helix* (*Hyalina*) *minima* of J. C. Cox, Monograph of Australian Landshells, in 1868, 10. Louis Pfeiffer mentions another *Helix minima* in his Monographia Heliceorum Viventium, vol. 7, 1876, p. 112, but this species was described as *Macrochlamys minima* by H. Adams in the Proceedings of the Zoological Society of London in 1867 on page 303.

W. G. Binney in the Smithsonian Miscellaneous Collections, vol. 5, 1863, in the "Bibliography of North American Conchology previous to the year 1860," on page 253, lists Joseph True's article "Shells Gathered about Salem, Mass., with particular localities designated, and remarks on the species," but does not give the complete list of shells. Binney's list ends with *Crepidula fornicata*, which in True's list is at bottom of page 192 in the Proceedings Essex Institute, at the end of signature 24 of volume 2. Signature 25 begins on page 193, the part which contains the description of *Helix minima*, which part apparently Binney did not see, otherwise he would have mentioned this species in his Manual of American Land Shells and other works.

From the above evidence *Helix minima* True can be regarded as a synonym of *Punctum minutissimum* (Lea).

A MOLLUSCAN MASS GRAVE

By MORRIS K. JACOBSON

Our larger eastern American land molluscs, with some exceptions, are notoriously solitary in habits. Hence reports of any large congregations of a pulmonate so persistently solitary as *Triodopsis tridentata* (Say) might prove of some interest, especially if such congregations take place in so unfavorable a location as the limestone-free and granitic region about Peekskill, New York.

On July 30, 1943, I uncovered a "grave" of thirty-one mature bleached and eroded but completely identifiable specimens of the above named species in a crevice between two soil-covered rocks on the eastern slope of a small ravine. The space the shells occupied was about three inches deep and two inches across and was generously filled with gravelly sand. The molluscs were packed tightly one against the other, with a thin layer of sand between.

That this congregation was not brought together by a mechanical agent, but rather resulted from the voluntary actions of the animals themselves, must be assumed from the following facts:

(1) Since only one species was represented among the specimens, it is hardly likely that a bird or animal collected them, since the existence of so selective a molluscophage has not been demonstrated in this section of our country.

(2) There were no streams or rivulets near the grave site, even if it could be assumed that a stream could bring such a collection together.

(3) Had a conchologist collected the molluscs, it is inconceivable that he would have left so rich a haul in the field.

It must be assumed then that our unfortunate molluscs gathered under conditions described as follows by Binney in 1869 (Smith. Misc. Coll. 194, Part I, P. 2):

> In the early days of spring, they (the Geophila) sometimes assemble in considerable numbers, in warm and sunny situations, where they pass hours of indolent enjoyment of the warmth and animating influence of the sunshine. Whether these meetings serve any useful purpose in the economy of the animal, or are caused by the pleasurable sensation, and renewed strength derived from the warmth of the situation after the debility of their winter's torpidity is uncertain; it is probable, however that they precede the business of procreation. It is certain that they last but a short time, and that after early spring, the animals are to be found in their usual retreats."

The answer to the question of what caused the wholesale slaughter I uncovered, can perhaps be seen in an uprooted tree, some yards above the grave site. In early March some years ago, while our molluscs were thus basking in the warming rays

of the sun, a sudden storm uprooted the tree and the ensuing rain washed a miniature landslide over our luckless congregation in the stone crevice. Just below the grave I found seven more shells, probably members of the same group.

Although such an occurrence must be very rare indeed, perhaps it can find a place among the list of natural controls of the mollusean population. At any rate it shows that the effect of storms and rains cannot be entirely excluded.

SNAILS HOARDED BY *BLARINA* AT ITHACA, NEW YORK

By WILLIAM MARCUS INGRAM

Mills College, California

It is well known that the short-tailed shrew, *Blarina brevicauda* (Say), hoards snail and insect food (Merriam 1886), (Shull 1907), (Hamilton 1930). Additional information is presented here concerning the interesting storage habit of *Blarina* These data were gathered from a small, rock strewn, sycamore flood plain in Six Mile Creek near Cornell University, Ithaca, New York. The period of observation extended from September 15, 1940, to January 3, 1941. Shrews were found hoarding snail food in both the fall and winter. Previous observations made from June 15 to September 1, 1940, on the Edmund Niles Huyck Preserve, Rensselaerville, Albany County, New York, have shown that Blarina will also hoard food during the summer months even though a food supply is abundant.

One shrew storage chamber opened in September revealed living individuals of the following species of mollusks: one *Anguispira alternata* (Say), three *Stenotrema hirsutum* (Say), and two *Ventridens intertextus* (Binney). These snails were active and were in no way injured. Five days later the storage chamber was reopened; all of the snails but two *S. hirsutum* had been broken open and eaten. The two unaccounted for *S. hirsutum* were nowhere to be found; no additions had been made to the storage chamber in the five day interval.

On December 24 a flat rock, 6 x 8 inches, was overturned revealing a vacated shrew discard shell chamber. Fairly fresh shrew scats showed that it had not long been abandoned. Twenty-nine empty mollusk shells and two opened chrysalis cases were scattered about. The snail species were: *Triodopsis albolabris* (Say), three adult and ten young; *Mesodon thyroidus* (Say), six adult and three young; *Triodopsis tridentata* (Say), five adult; *Succinea ovalis* Say, one adult; and *Haplotrema concavum* (Say), one adult. All individuals but the *S. ovalis* and the *H. concavum* had been opened. The majority had had the spires cut away by *Blarina* in order that the soft bodies could be removed by the small mammal. The breaking open of large shells by the short-tailed shrew as well as small is contrary to Shull (1907) who states, "It seems from these observations that in the case of large shells, breaking is a last resort." Dr. William J. Hamilton, Jr., of Cornell University in studying *Blarina* about New York State, has observed, as has the writer, that when large shells are found in shrew runs they are usually broken. Two of the species of mollusks that Shull (1907) studied in Michigan abound in shrew runs in Ithaca; these are *T. albolabris* (Say) and *M. thyroidus* (Say).

On January 16 while conducting an invertebrate zoology field trip two winter storage piles of *Blarina* were observed. One of these contained twenty-seven individuals representing five species, and the second fifteen individuals representing two species. In the first storage chamber all mollusks were stacked in a cavity in a sycamore stump. They were resting on the ground; snow had filtered into the cavity and was banked around the bottom layer of shells. The shells were frozen together and formed a roundly triangular-shaped mound. When these mollusks were carried into the laboratory all were prodded with a glass rod but none showed signs of life. All were gradually thawed out over forty-eight hours, but none recovered from the freezing to which they had been subjected in the shrew storage chamber. The fact that the snails were apparently frozen solid would have prevented these mollusks from crawling away. Twelve individuals had complete epiphragms, three had incomplete ones, and twelve had no epiphragms. Five *M. thyroidus* without epiphragms showed that epiphragms had at one time been pres-

ent, for fragments were found adhering to the apertures of the shells. These epiphragm fragments possibly indicate that the epiphragms had been broken by the shrews in their collecting efforts; too, the indication may be that in transporting the large shells *Blarina* often carries them by gripping the outer lip. The entrance into the shrew run was just behind the pile of mollusks. Several shell fragments and seats in the region of the pile indicated that mollusks in the storage pile were being fed upon above the ground. The mollusk species were: *M. thyroidus* (Say), fourteen mature and nine immature, and one adult of each of the following species, *Ventridens intertextus* (Binney), *Anguispira alternata* (Say), *Mesomphix cupreus* (Rafinesque), and *Triodopsis notata* (Deshayes).

The second winter storage chamber was three feet from the first, situated between two small sycamore stumps. Snails of this group were not piled but were scattered over the ground. When they were subjected to the prodding test none showed signs of life, nor did any become active during the gradual forty-eight hour thawing period. The snail species in the pile were eight adults and six young of *M. thyroidus* (Say) and one adult of *A. alternata* (Say).

No empty shell were found in either of the above storage piles, indicating that shrews probably distinguish empty shells from occupied ones by smell or weight and generally do not bother to carry empty shells to their storage piles. None of the mollusks in the storage piles had cracked shells indicating that for the *Blarina* studied, freezing rather than injury is "relied upon" to prevent the food supply from wandering off.

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SHELL CLEANING AND EPIPHRAGM REMOVAL BY TRIODOPSIS ALBOLABRIS (SAY)

BY WILLIAM MARCUS INGRAM

Mills College, California

The included data show that the land snail, *Triodopsis albolabris* (Say), will on occasion spend a considerable period removing foreign material from the surface of its shell. The removal of the epiphragm terminating aestivation is also described. The included information is based on observations of specimens collected during the last week in August 1940 on the Edmund Niles Huyck Preserve, Rensselaerville, Albany County, New York.

Shell Cleaning—The 15 specimens upon which these observations are based were transported to Cornell University, and in January 1941 were moved to the zoological laboratory of Mills College where the shell cleaning occurred.

The snails were placed in a terrarium supplied with a covering of black loam soil planted with Wandering Jew. Soon after the snails were transferred to the terrarium it was observed that the loam soil often became caked on their shells, and occasionally accumulated in such quantity that the suture lines were obscured. The initial cleaning action was noted after the snails had been in the terrarium 2 months. One snail was first observed greatly extended with its anterior foot region curved over the dorsal shell surface. On close examination its lips were observed moving, and the soil covering the shell could be seen being filed away through the action of the radula. The soil was not scraped off and dropped by the snail, but was carried into its alimentary canal. Continued observation of the 15 snails showed that on occasion all were scraping soil from their shells.

One snail continued cleaning the surface of its shell for 75 minutes. This individual was especially active in removing soil which had become caked in the shell sutures. Its posterior foot region, about one-third of the total length of the foot, held the animal on one upright wall of the terrarium. The remainder of the foot was stretched back over the shell as far as the apex. The individual was seen to be moving its head slowly along the

sutures with its lips continually in motion. The cleaned shell areas stood out in bold contrast to the uncleaned shell portions. The great extensibility of the foot allowed this snail to move its head around the apex; considerable time was spent in ridding the apex of the accumulated soil.

Other snails were observed lying on the bottom of the terrarium with the foot held free of the substratum. In such a position they would twist and turn their heads about, filing at their fouled shells. One area which was continually cleaned was the umbilical region.

The fecal strings of snails which had but recently cleaned their shells of accumulated soil were commonly black in color; on occasion fecal masses were sprinkled with black spots. The dark colored soil in the fecal strings was easily distinguishable, for due to the snails' lettuce diet green colored seats were produced. If shell cleaning does occur in the natural habitat of this species the observer would not likely be able to detect the presence of soil in the fecal strings without a careful examination, for the soil color would blend in with the typical dark green to dark brown and greyish-black fecal strings which are characteristically deposited by this snail species under natural conditions.

Such shell cleaning employed by *T. albolabris* if carried on in its natural environment would probably reduce shell corrosion. Extensive corrosion of the apical whorls if continuous might expose vital parts. Thus soil removal in riding the shell of accumulated soil and organic matter possibly enhances the survival rate of individuals to some slight degree. Collected data indicate that under natural conditions soil probably does not accumulate on shells to any great extent. Of 500 shells of living snails, *T. albolabris,* examined only 11 individuals collected during the summer of 1940 on the Huyck preserve had badly fouled shells; 8 of the 11 were taken from a flood plain beneath water carried debris piles resting on loam soil. All but 3 specimens from beech-hemlock, beech-maple, and maple areas had clean appearing shells. Under the humus-log habitat in the above forest areas snails are not directly associated with a soil substratum; thus situated, soil would not accumulate to any great extent on the shell.

Two other species of snails, *Mesomphix cupreus* (Raf.) and *Helicodiscus parallelus* (Say), were kept in the same terrarium with *T. albolabris*. Individuals of these two species were never observed cleaning their shells. Five specimens of the former species possessed corroded apical whorls after 2 months; the apical whorls were without noticeable corrosion when they were placed in the terrarium. The 2 individuals of *Heliocodiscus* did not have corroded shells at the end of the same period.

Epiphragm Removal—Five individuals form the basis for these observations. They were forced into aestivation by removing all moisture from their container through the medium of cotton. They were allowed to remain aestivating for 72 days. They were then returned to a moist container with food consisting of apple, carrot, and carrot leaves. One hour after they had been transferred to the more favorable situation they had commenced to break through the epiphragm.

Concerning epiphragm removal by land snails in general after hibernation Binney (1885) writes, ". . . the animal breaks down and devours the membraneous partitions [epiphragms] and comes forth to participate in the warmth and freshness of the season. At first it is weak and inactive, but, recovering in a short time its appetite, resumes its former activity." Binney does not state in detail how epiphragm removal is accomplished. The feat of a snail ridding itself of this resistent membrane warrants a complete description of the removal process.

In the 5 individuals observed pressure by the posterior tip of the foot initiated the removal process. The foot tip was brought into contact with the epiphragm and by continual pressure was finally thrust through it at the columellar region. When the foot emerged it carried a portion of the epiphragm with it and left an opening through which the remainder of the snail's foot and the head could make an exit. The time taken by the foot to pierce the membrane after it had made contact varied from 1 to 2 minutes.

After the foot had torn a part of the epiphragm away the remainder was left attached at the lip of the shell around the aperture. As the anterior body region of the snail continued to emerge still more of the adhering epiphragm was carried away. As the head appeared it was brought in contact with the epi-

phragm, and soon the mouthparts of the snail were observed filing away at the epiphragm remnants. Each of the 5 snails began a systematic cutting away the epiphragm at the lip region opposite the columella. As the fragments were torn away in this region the snail continued its feeding around the aperture lip until all the membrane had been cleared away. Then the snail moved its head into the interior of the body whorl just behind the lip and began cleaning the internal shell surface. This done the snail thrust the mantle, which had until up to this time been held back from the lip, forward into its normal position and began to crawl over the substratum. The time taken to clean the epiphragm away and to explore body whorl behind the lip varied from 5 to 10 minutes in the 5 individuals.

The weakness which exists in snails just emerging from hibernation as reported by Binney[1] (1885) was not noticeable in these snails emerging from aestivation. Generally speaking hibernating snails go through a dormant period from approximately 4 to 7 months, and a weakness can be readily understood. However, the five 72 day aestivating snails immediately began to feed on the provided food supply.

In summarizing the mechanics of epiphragm removal both the foot and the radula are employed. Evidence indicates that the part of the epiphragm that is cut away by the radula is swallowed by the snail.

NOTES AND NEWS

We have to record the death at the age of 78 of Frank Harvey Eno, of Columbus, Ohio, on August 7th of last year. Professor Eno's vocation was civil engineering, but as a hobby he was interested in mollusks.

Precedence.—Before the idea came to Dr. Merrill Moore, in fact just a little short of one hundred years ago, Fredricka Bremer, the traveler and writer, wrote home to Sweden from Philadelphia: "There is a beautiful museum [here] of stuffed birds and other animals, with collections of shells and minerals, where the diseased mind may divert itself and derive instruction."—Calvin Goodrich.

[1] Manual of American Land Shells, Bull. 28, U. S. Nat. Mus.

An Autobiography of Norman Wallace Lermond, to be published by subscription, has been announced.

Extended Ranges of Four Alaskan Marine Shells.—In checking over part of my rather extensive collection of Alaska shells four species were noted that were taken from beyond previously reported geographic ranges. All except *Chrysodomus saturus* Martyn were known previously only from the type localities. In two issues of The Nautilus, January and April, 1938, I reported "Extended ranges of seventy-five species of north Pacific shells collected by Walter J. Eyerdam and Ingvard Norberg."

(1) *Liocyma schefferi* Bartsch & Rehder. Type locality, Chuginidak I., Aleutian Is.; coll. by W. J. Eyerdam, two specimens. Taken at Atka I., Aleutian Is., 1932. Extended range, about 250 miles westward.

(2) *Volutopsius fragilis* Dall, 1891. Type locality, Unimak I., Aleutian Is.; coll. by W. J. Eyerdam at Dutch Harbor, Aleutian Is., one perfect live adult specimen found on a rock at low tide mark. It is nearly the exact dimensions of the type specimen. Extended range, about 200 miles westward.

(3) *Cingula eyerdami* Willett. Type locality, Evans I., Prince William Sound; coll. by W. J. Eyerdam at Shuyak Strait, Afognak I. Numerous specimens from the second locality were taken from the siftings of nullipores by W. J. E. in 1924. Extended range, about 200 miles westward.

(4) *Chrysodomus saturus* Martyn. Type locality, King Georges Sound, Hudson Strait, Labrador. Range, Arctic Ocean from Hudson Strait to Bering Strait; Plover Bay, Siberia, South and East to Cape Douglas, Alaska. While studying some of the marine shells in the museum of the University of Tomsk, Siberia, in 1930 I was given several Arctic Siberian shells collected by the Nordenskjöld Expedition in 1878, from near the mouth of the Yenisei River at the village of Pustoje. One of these shells is a near typical example of *C. saturus* although slightly more slender and not quite so heavy. Extended range, about 3000 miles westward.—Walter J. Eyerdam.

Note on Fasciolaria Distans Lam.—This past summer (1943) after a collecting trip to Bogue Sound, near Beaufort, N. C., all of the live specimens were placed in a large basin of

sea water for further observation. Among them were several *Fasciolaria distans* Lam. and a number of *Urosalpinx cinereus* Say. One of the *Urosalpinx* crawled onto the shell of a *Fasciolaria distans* and was observed moving its shell from side to side, as if starting to bore. Almost immediately, the *Fasciolaria* twisted its foot and jumped no less than a good two inches. It continued doing this for several minutes, travelling in a zigzag manner which threw the shell violently from side to side, until it had succeeded in dislodging the *Urosalpinx*.

Fasciolaria is common in this locality and I have been able to observe many of them. Prior to this, I had found them to be very sluggish, but this animal jumped as much as any *Strombus pugilis alatus* Gmel. that I have ever seen, and I wondered if this was a common means of protection against the borers. Later I examined the shells of some fifty *Fasciolaria* which I had collected at various times and found that not one of them showed any visible signs of having been attacked by *Urosalpinx*. This is not to say that the borer is never successful in its attacks, but it does seem to indicate that the usually slow-moving *Fasciolaria* probably uses this means of defense to its advantage, and that it manages to escape its unwelcome guest more often than many of the more active mollusks.—Anne Gray Hackney.

Note on Busycon Carica (Gmelin).—*Busycon carica* is a common species in the Sound in the vicinity of Beaufort, N. C. Occasionally, a specimen is found which has a double row of spines; that is, an extra row between the suture and the peripheral keel, on the body whorl. Usually, in the specimens that the writer has seen, they are noticeable only in this position on the shell, but sometimes a definite ridge is apparent in the same relative position on the spire. The writer has in her collection *Busycon carica,* from New Jersey, Maryland, Virginia and the Gulf of Mexico, but none of these has any indication of this supposed abnormality. This aberrant form may be common elsewhere, but the writer thought it worthy of mention, as she, at least, has not found them in any other locality.—Anne Gray Hackney.

Albino Specimen of Busycon Perversum L.—On one of our collecting trips near Beaufort, N. C., my younger son found a live specimen of what we supposed was an albino *Busycon per-*

versum L. The shell was pure white, both inside and out, but the animal was quite as jet black as any other normal *B. perversum*. A thin yellow periostracum was present and we were able to see no difference in the coloring of the operculum from any other *B. perversum*. I have not had the opportunity of seeing any other live albino specimens, and I can find very little written on the subject.—Anne Gray (Mrs. J. M.) Hackney, 1333 Cornwall Place, Norfolk 8, Va.

"Hemphill's Catalogue of the land and freshwater shells of Utah," 1878, was noticed in January Nautilus. It is a little 4-leaf sale catalogue. The following names occur among many unnamed varieties listed by number, each followed by a word or two noting some peculiarity.

"Patula Hemphilli var. Utahensis, keeled, smooth.
" " var. Oquirrhensis, revolving ribs.
" Haydeni var. Gabbiana. Ribs nearly obsolete.
" Idahoensis var. Wassatchensis." (No definition, though this together with 21 other varieties of *idahoensis* listed by numbers, are said to "have more than double the number of ribs or plicate striae than the typical form."))

In a prefatory note Hemphill states that the shells in the catalogue were collected "in the canyons of the Wassatch Mts., Utah." But his specimens of the first three varieties, according to the specimens he sent out, and later publications, were from the Oquirrh range, mountains entirely distinct from the Wasatch range. This misstatement of locality, together with the brevity of the remarks, in no case diagnostic, and the reference of *utahensis* and *oquirrhensis* to the Nevadan *"Patula" hemphilli*, would leave the forms quite unrecognizable without the aid of subsequent literature or specimens.

The question whether this sale catalogue and other similar leaflets sent out by Hemphill to advertise his shells, would be considered published, in the sense of the International Rules, is also to be decided, and of course opinions may differ. I did not consider it a scientific publication; it was evidently not so intended; and I think that it would be an error to date from it the oreohelices subsequently described under similar names. The line has to be drawn somewhere!—Pilsbry.

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EDITORS AND PUBLISHERS
HENRY A. PILSBRY, Curator of the Department of Mollusca, Academy of Natural Sciences, Philadelphia

H. BURRINGTON BAKER, Professor of Zoology, University of Pennsylvania

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A QUARTERLY
DEVOTED TO THE INTERESTS OF CONCHOLOGISTS

EDITORS AND PUBLISHERS
HENRY A. PILSBRY, Curator of the Department of Mollusca, Academy of Natural Sciences, Philadelphia 3, Pa.
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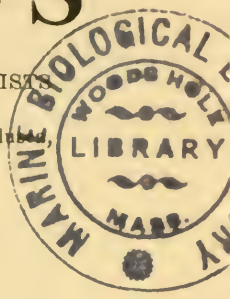

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